Nokia Customer Care

Service Manual

RM-465 (Nokia 5730 XpressMusic; L3&4)
Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	05/2009	MT	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia 5730 XpressMusic; L3&4 Service Manual Structure

1 General Information
2 Service Tools and Service Concepts
3 BB Troubleshooting
4 RF Troubleshooting
5 Camera Module Troubleshooting
6 System Module and User Interface
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1 — General Information

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Product selection

RM-465 is a quad-band smartphone supporting GSM/850/900/1800/1900 with WCDMA VIII (900)/ II (1900)/ I (2100). The device also supports EDGE, GPRS and HSDPA data bearers.

There is an integrated 3.2 MP camera with auto-focus and flash with 320 x 240 QVGA 2.4”display, 16M colors in the device and front camera for video call.

The device uses Symbian 9.3 operating system and supports MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

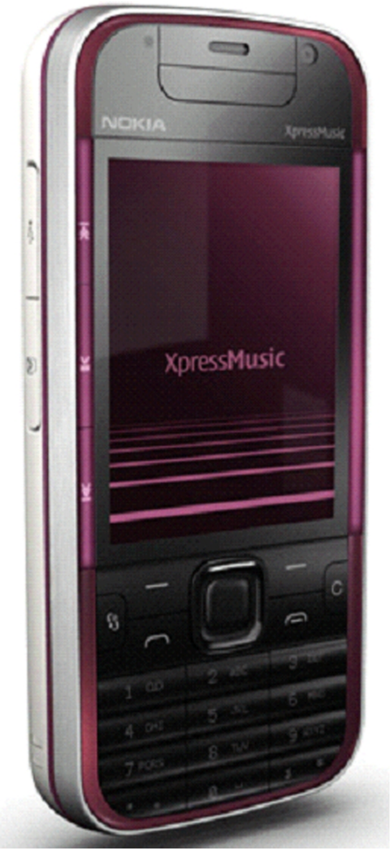

Figure 1 View of RM-465

Product features and sales package

Imaging

- 3.2 MP camera with auto-focus and flash
- QVGA, front camera for video call

Connectivity

- A-GPS
- Bluetooth 2.0, multiple BT connections supported
- WLAN 802.11g
- USB 2.0 (High speed 50 MB/s), support charging
- Dual Transfer Mode (MSC 5, class 11)
- 2.0mm charger connector

Context Management

- OMA Client provisioning
- PC Suite for local data sync
- FOTA Nokia software updater

Voice

- Integrated hands free and conference call
- Voice recording
- Mute key
- Standardized Push To Talk (OMA PoC Rel. 1.0 standard)
- Internet call (SIP VOIP ver.3.0)

Office

- Standards-based push email supported: POP3, SMTP, Mail for Exchange, IMAP4 (with idle)
- Quick office editors (document, spreadsheet, and presentation)
- PDF Viewer, ZIP Manager, S60 File
- Manager
- Search
- Message Reader
- Active Notes
- Contacts (w/images)
- Calendar and To-do (task list)

Security

- Device lock
- SSL 3.0/TSL 1.0
- Integrated Nokia Mobile VPN
- Device and memory card data encryption
- OMA Digital Rights Management 2.0

Productivity

- Home screen Modes – Business and Personal
- One-touch keys (Home, Calendar, email)
- Predictive text input
- Accelerated scrolling
- Download!
- Offline mode

Key Customization Elements

- UI themes
- Wallpapers, ringing tones, wake-up graphics
- Operator menu, branded soft key and embedded links

- Co-label logo front and back
- Operator keys (Email or/and Calendar key)

Sales package

- Transceiver RM-465
- Charger (AC-5E)
- Battery (BL-4U)
- Connectivity cable (CA-101)
- MicroSD card (4GB)
- Stereo headset (HS-45 + AD-54)
- User guide

Other

- SMS, MMS
- OMA Instant Messaging and Presence Service
- OMA email notification
- Media Consumption and Publishing
- Java™ MIDP 2.0
- Nokia Mini Map browser
- JavaScript 1.3 and 1.5 support
- FM radio
- Music player (MP3, AAC), Media player

Mobile enhancements

Table 1 Chargers

Enhancement	Type
Travel charger	AC-8
Mobile charger	DC-4

Table 2 Audio

Enhancement	Type
Stereo headset	HS-43
Basic headset	HS-48
Stereo headset	HS-45/AD-54

Enhancement	Type
Bluetooth headset	BH-101
	BH-102
	BH-212
	BH-602
	BH-702
	BH-803
	BH-804
	BH-902
	BH-903
	BH-904
Pocket speakers	MD-6, MD-8

Table 3 Car

Enhancement	Type
Multimedia car kit	CK-300

Table 4 Data

Enhancement	Type
Connectivity cable (charging)	CA-101
Connectivity cable (charging)	CA-126
MicroSD card	MU-37, 2 GB MicroSD Card
	MU-41, 4 GB MicroSD Card
	MU-43, 8 GB MicroSD Card

Table 5 Power

Enhancement	Type
Battery 1000mAh Li-ion	BL-4U
Travel charger	AC-8

Technical Specifications

Transceiver general specifications

Unit	Dimensions (L x W (close /open) x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-4U 1000mAh li-ion battery back	112.2 x 51.3 / 81.3 x 14.9	139	78

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA II (1900): 1930-1990MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA II (1900): 1850-1910MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA II (1900): -50 ... +24dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW

Parameter	Unit
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA II 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA II (1900): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-4U	1000	Up to 3.5 hrs (WCDMA), 5 hrs (GSM), 5.5 hrs (WLAN)	Up to 9 days (WCDMA) and 9.5 days (GSM)

Charging times

AC-5E
1h 30 min

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-10 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods

Environmental condition	Ambient temperature	Notes
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

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2 — Service Tools and Service Concepts

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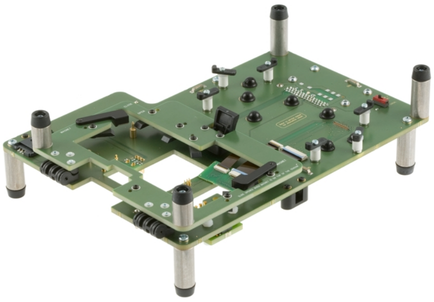
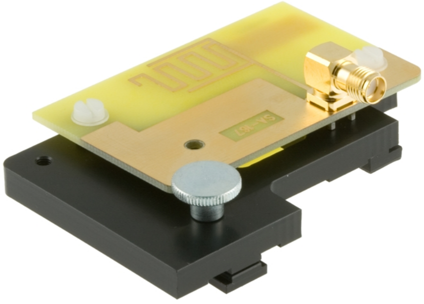
Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-465. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	FS-129	Flash adapter	
	• FS-129 is equipped with a clip interlock system • provides standardised interface towards Control Unit • multiplexing between USB and FBUS media, controlled by VUSB		
	MJ-180	Module jig	
	MJ-180 is meant for component level troubleshooting. The jig includes RF interface for Bluetooth, WLAN and GPS. In addition, it has the following features: • Provides mechanical interface with the engine module • Provides galvanic connection to all needed test pads in module • Multiplexing between USB and FBUS media, controlled by Vusb • Connector for control unit • Access for Audio-, MMC, and USB connectors		
	RJ-230	Soldering jig	
	The jig is used for soldering and as a rework jig for the system module. It is made of lead-free rework compatible material.		



SA-167	RF coupler	

SA-167 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following tables show attenuations for RM-465:

- **Attenuation values for inductive RF coupler SA-167 for RM-465**

Band	Channel	Attenuation RX	Tolerance RX	Attenuation TX	Tolerance TX
GSM 850	Low	4	+/-1.0	5.5	+/-1.0
	Mid	5		5.6	
	High	5		5.5	
GSM 900	Low	7	+/-1.0	5.1	+/-1.0
	Mid	8		4.8	
	High	9		5.8	
GSM 1800	Low	9	+/-1.0	9	+/-1.0
	Mid	8		9	
	High	9		9.2	
GSM 1900	Low	10	+/-1.0	9.3	+/-1.0
	Mid	9		9.7	
	High	10		10	
WCDMA Band I	Low	13	+/-1.0	9.3	+/-1.0
	Mid	12		9.5	
	High	14		9.8	
WCDMA Band II	Low	14	+/-1.0	9.7	+/-1.0
	Mid	12		10.7	
	High	13		10.2	
WCDMA Band VIII	Low	11	+/-1.0	6	+/-1.0
	Mid	11		5.9	
	High	12		5.7	

SS-100	Camera removal tool	

The camera removal tool SS-100 is used to remove/attach a camera module from/to the camera socket of the phone PWB.

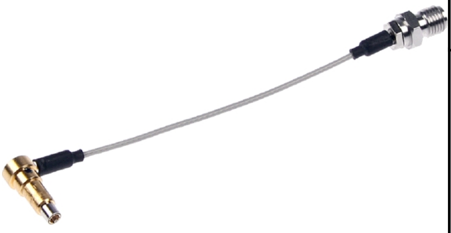
Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-465. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">

CA-101
100cm

</td><td>CA-101</td><td>Micro USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.</td></tr>
<tr><td rowspan="2"> </td><td>CA-31D</td><td>USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.</td></tr>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
</table>

	CA-56RS	RF cable	
	Small RF cable that is used for RF tuning with product specific module jig.		
	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		
	XCS-1	Service cable	
	The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

Service concepts

POS (Point of Sale) flash concept

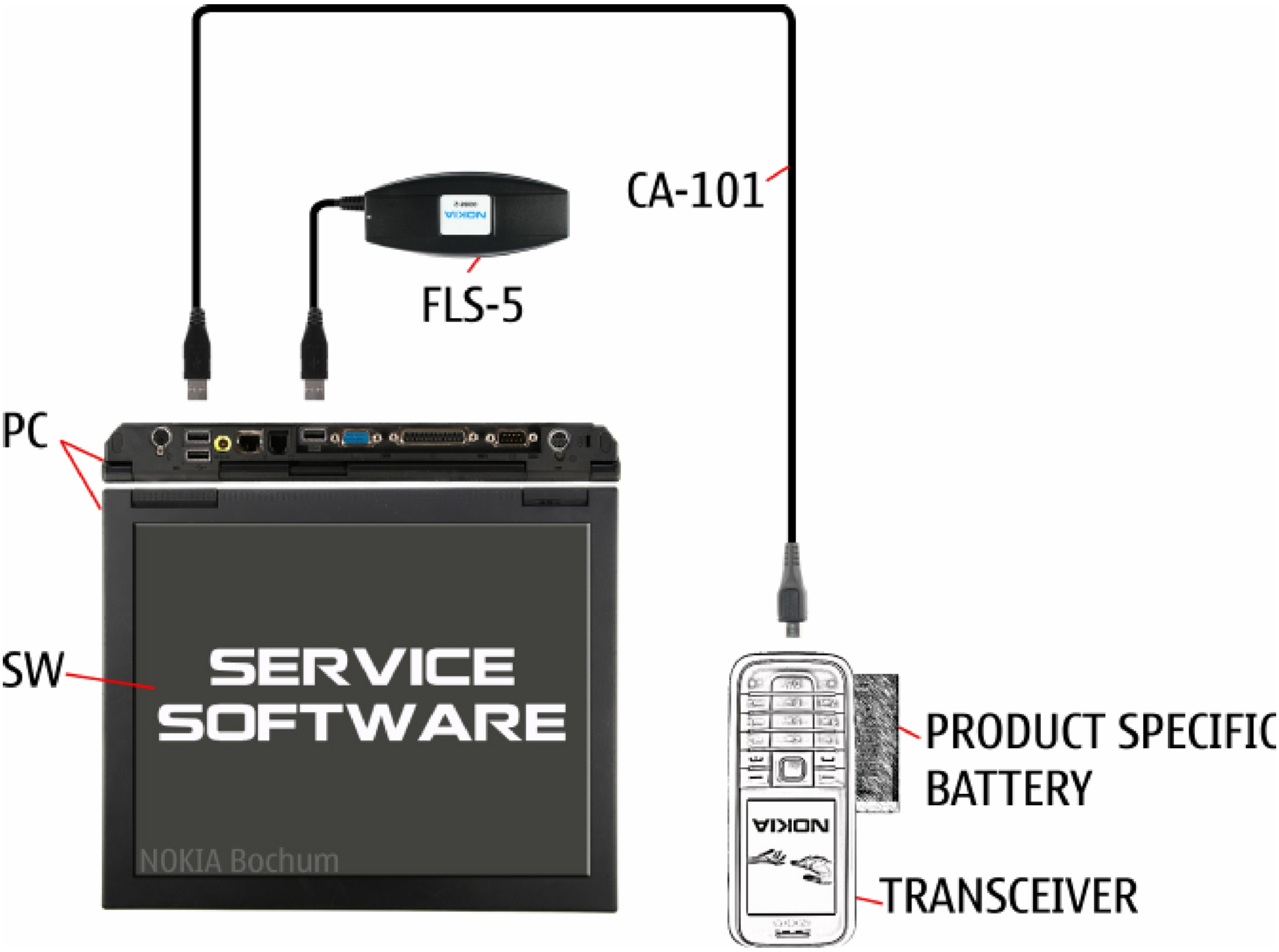

CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-4U	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

Flash concept with FPS-10

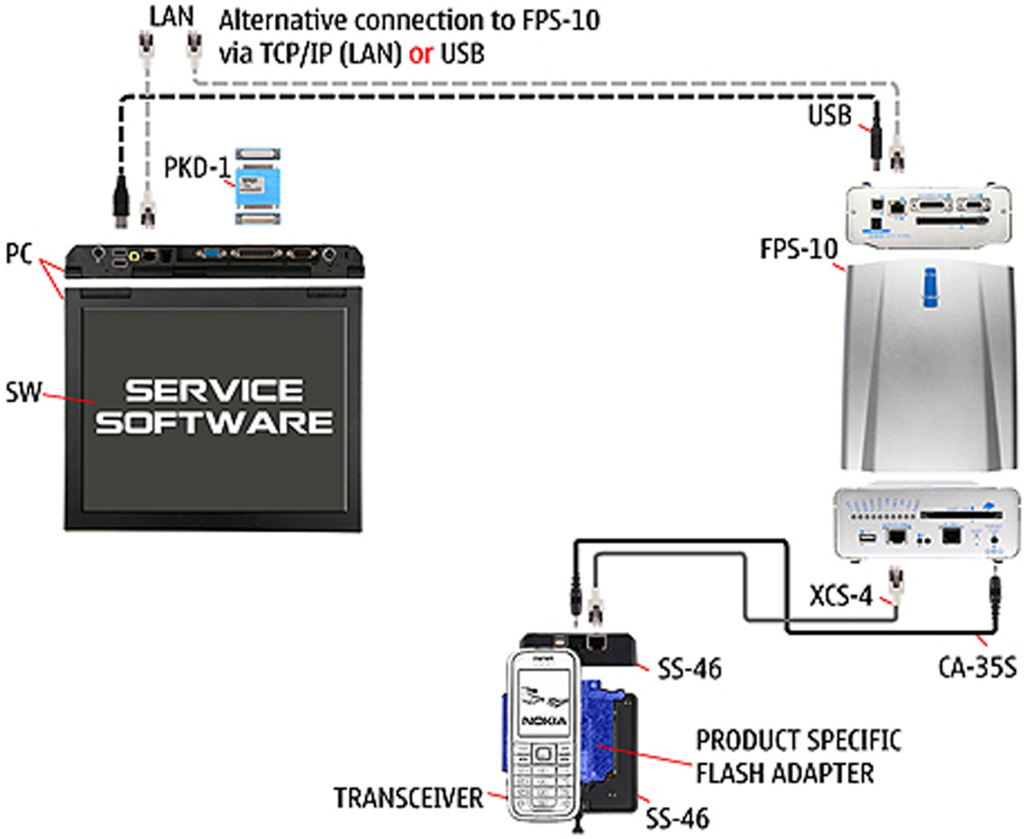

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-129	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

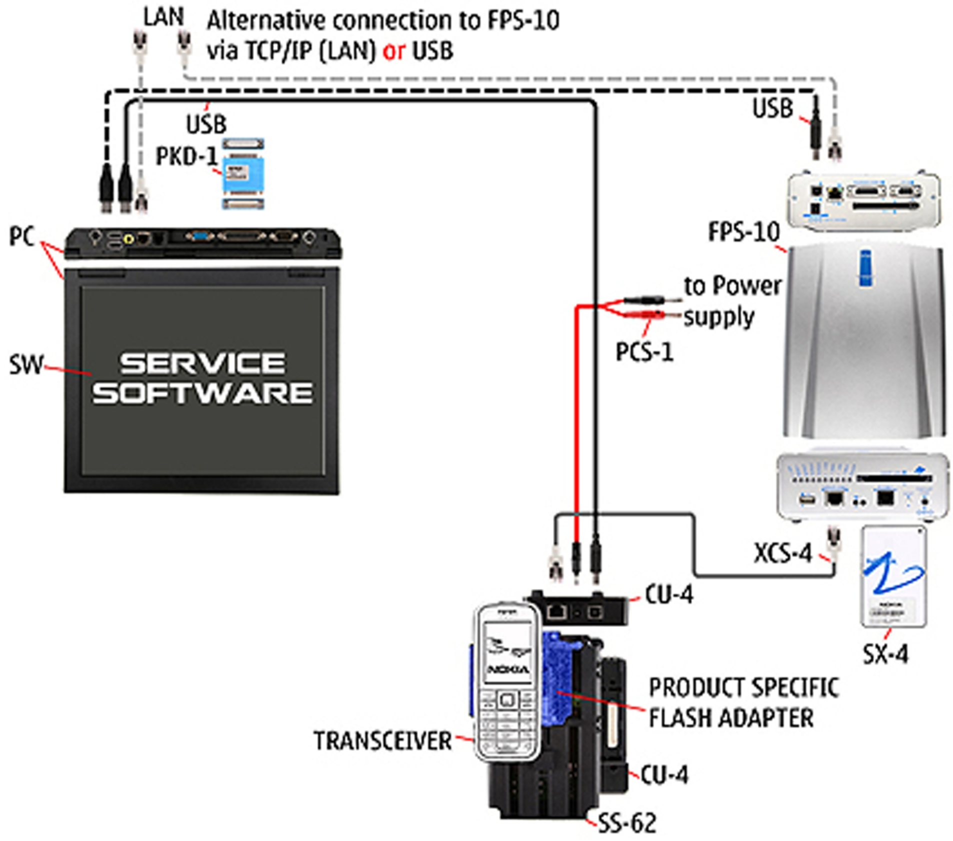

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-129	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Flash concept with FPS-10 and SB-6

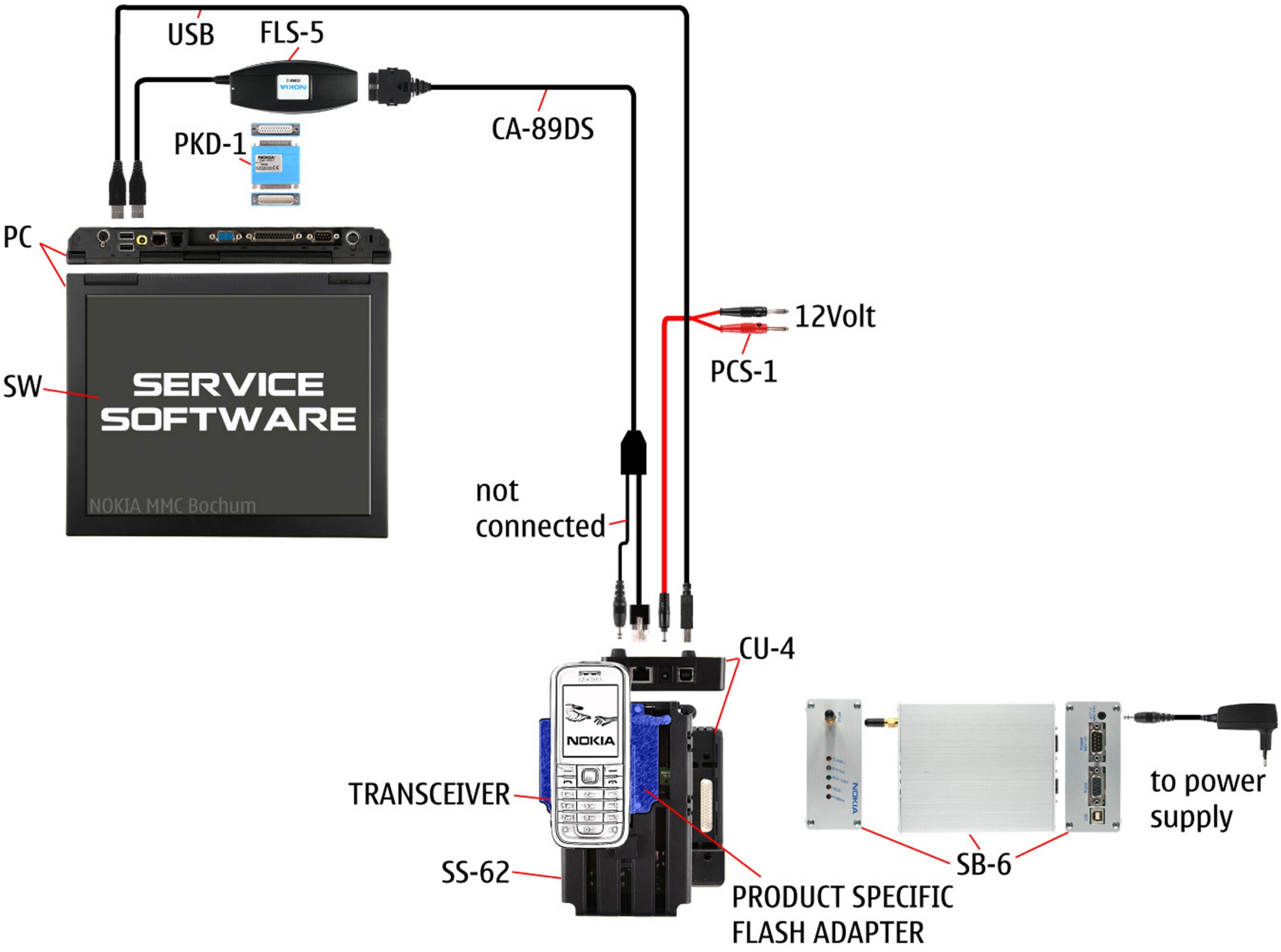

USB
FLS-5
PKD-1
CA-89DS
PC
SW
SERVICE SOFTWARE
NOKIA MMC Bochum
12Volt
PCS-1
not connected
CU-4
TRANSCEIVER
SS-62
PRODUCT SPECIFIC FLASH ADAPTER
SB-6
to power supply

Figure 5 Flash concept with FPS-10 and SB-6

Type	Description
Product specific tools	
FS-129	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
SB-6	Bluetooth test and interface box
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable

Type	Description
	USB cable

Flash concept with SS-46 and CA-89DS

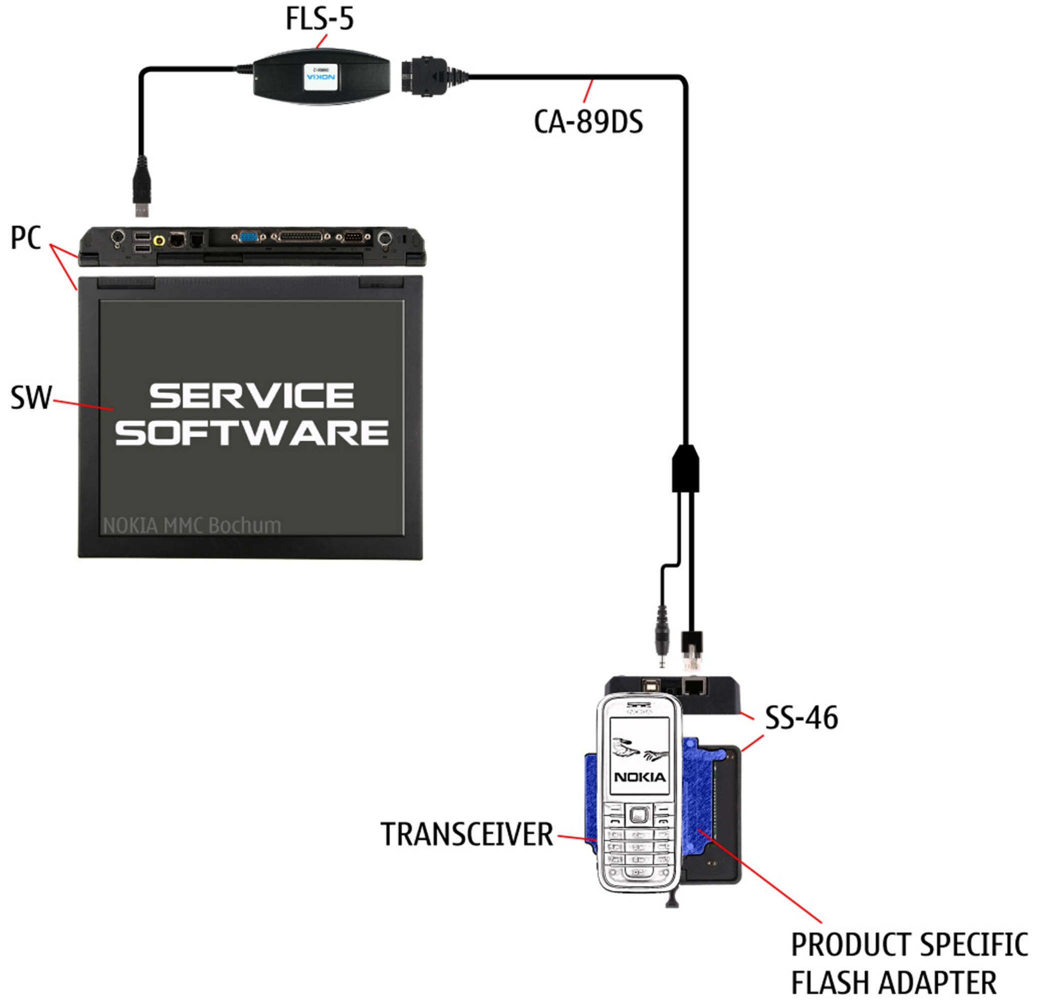

FLS-5
CA-89DS
PC
SW
SERVICE SOFTWARE
NOKIA MMC Bochum
SS-46
TRANSCEIVER
PRODUCT SPECIFIC FLASH ADAPTER

Figure 6 Flash concept with SS-46 and CA-89DS

Type	Description
Product specific tools	
FS-129	Flash adapter
Other tools	
FLS-5	Flash device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Cable

Flash concept with SS-62 and CA-89DS

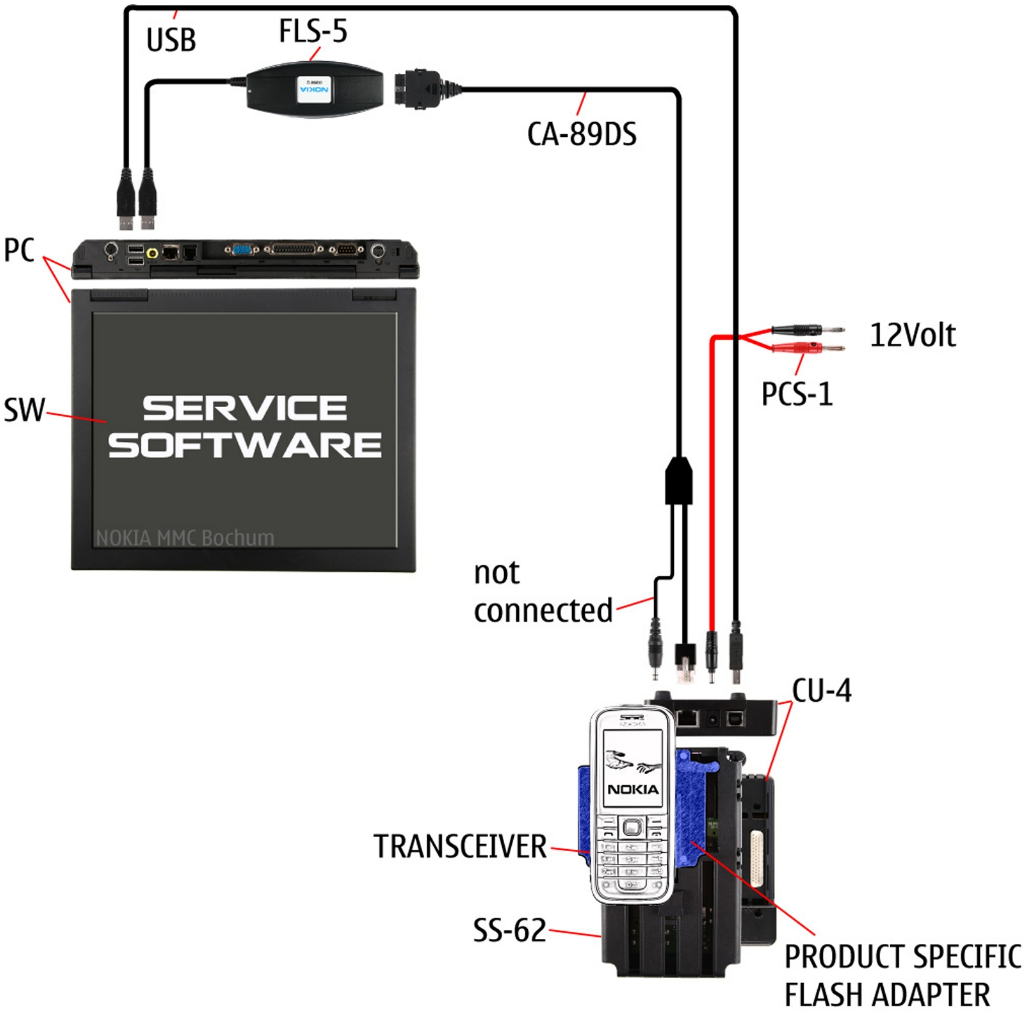

USB
FLS-5
CA-89DS
PC
SW
SERVICE SOFTWARE
NOKIA MMC Bochum
12Volt
PCS-1
not connected
CU-4
TRANSCEIVER
SS-62
PRODUCT SPECIFIC FLASH ADAPTER

Figure 7 Flash concept with SS-62 and CA-89DS

Type	Description
Product specific tools	
FS-129	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	Flash device
SS-62	Flash adapter base
	PC with Phoenix service software
Cables	
CA-89DS	Cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-10, SS-62 and SB-6

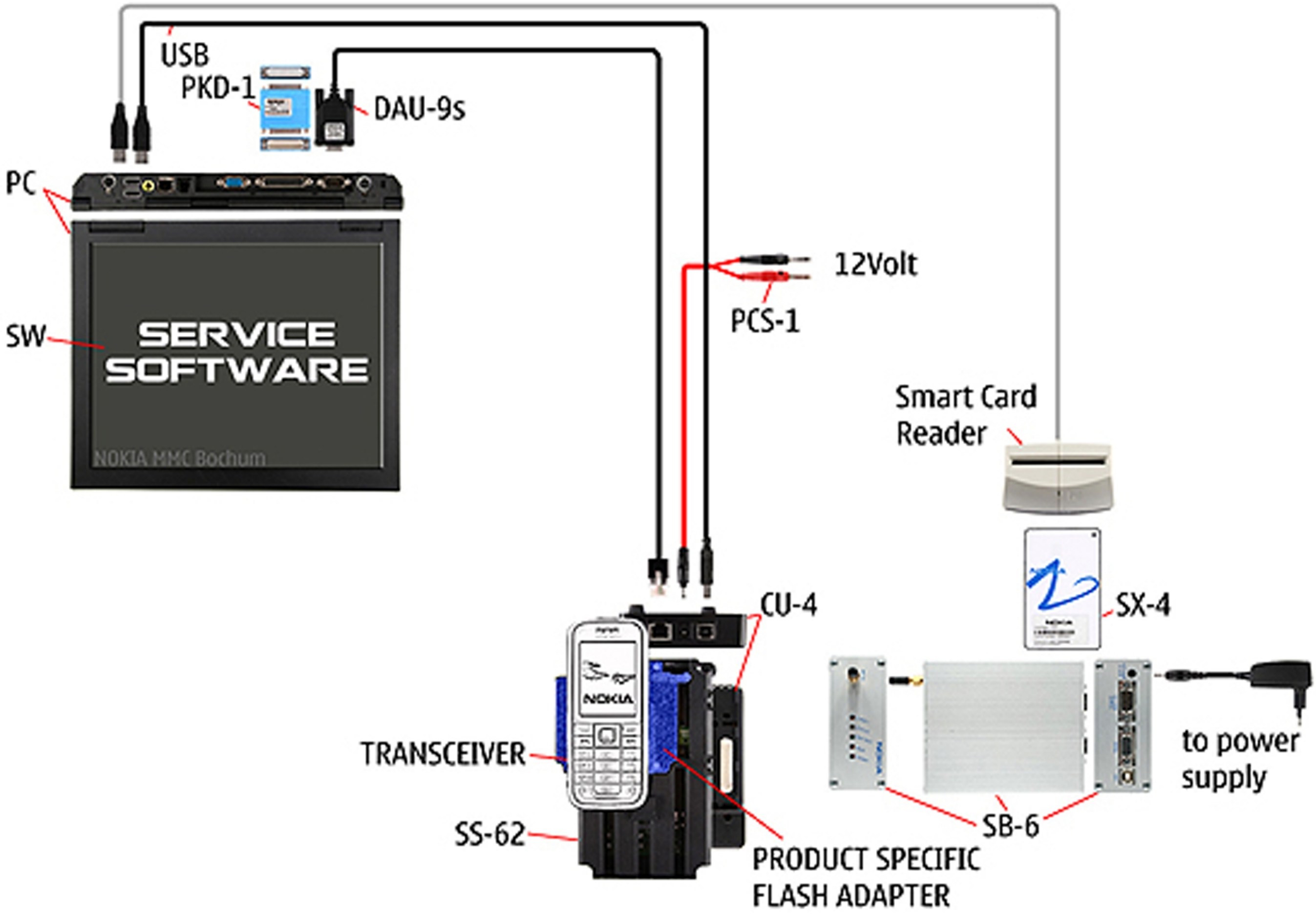

USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
NOKIA MMC Bochum
12Volt
PCS-1
Smart Card Reader
CU-4
SX-4
to power supply
TRANSCEIVER
SS-62
SB-6
PRODUCT SPECIFIC FLASH ADAPTER

Figure 8 Flash concept with FPS-10, SS-62 and SB-6

Type	Description
Product specific tools	
FS-129	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SB-6	Bluetooth test and interface box
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable

Type	Description
	USB cable

Flash concept with FPS-10, SS-62 and SB-7

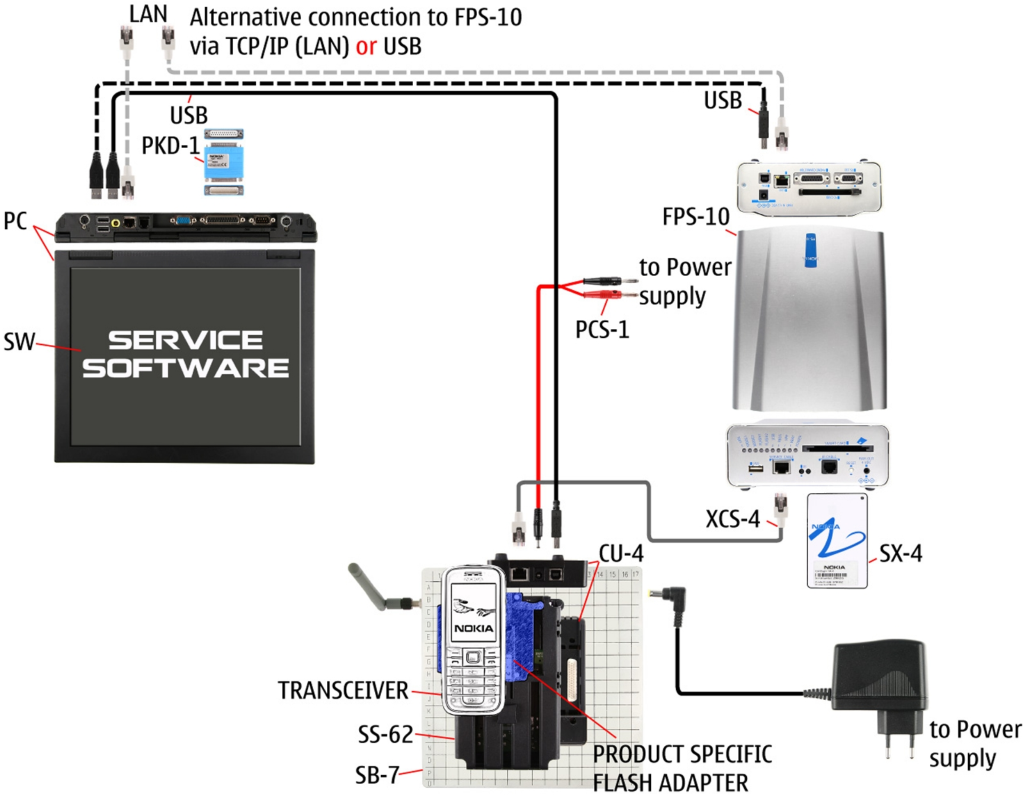

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
SX-4
CU-4
TRANSCEIVER
SS-62
SB-7
PRODUCT SPECIFIC FLASH ADAPTER
to Power supply

Figure 9 Flash concept with FPS-10, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-129	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable

Type	Description
	USB cable

Module jig service concept

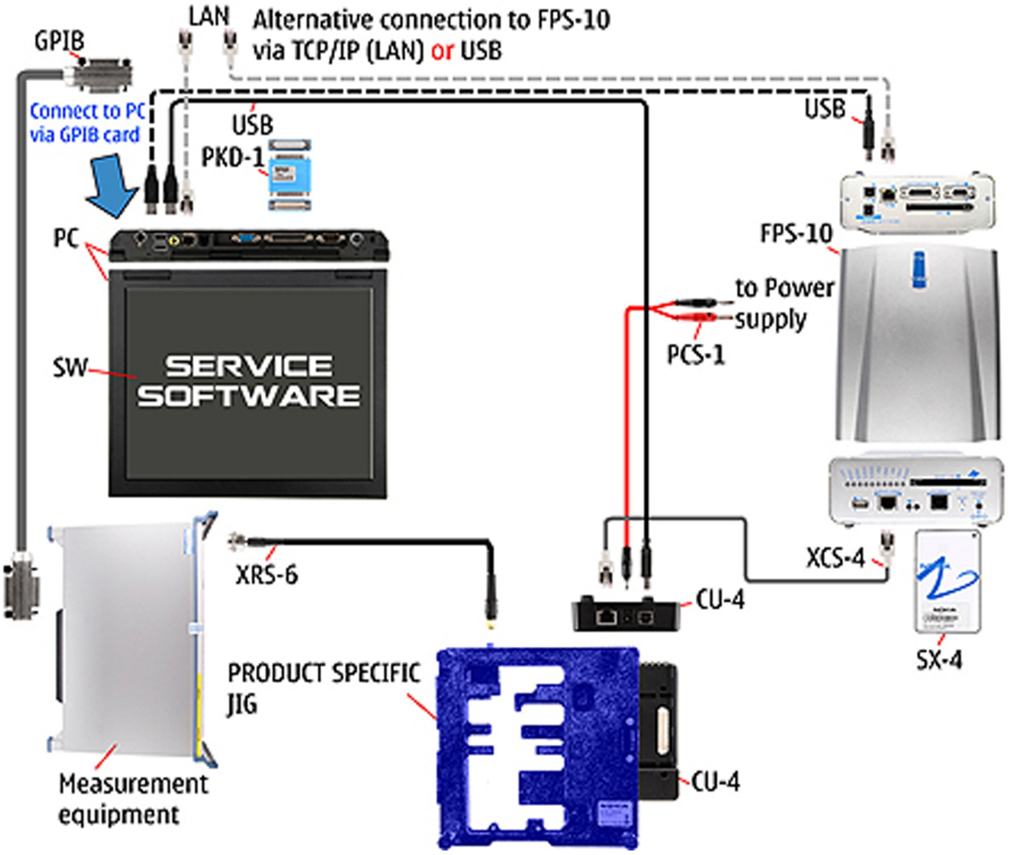

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
JIG
Measurement
equipment
CU-4

Figure 10 Module jig service concept

Type	Description
Phone specific devices	
MJ-180	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable

Type	Description
XRF-1	RF cable
CA-56RS	RF tuning cable
	USB cable
	GPIB control cable

Module jig service concept with SB-6

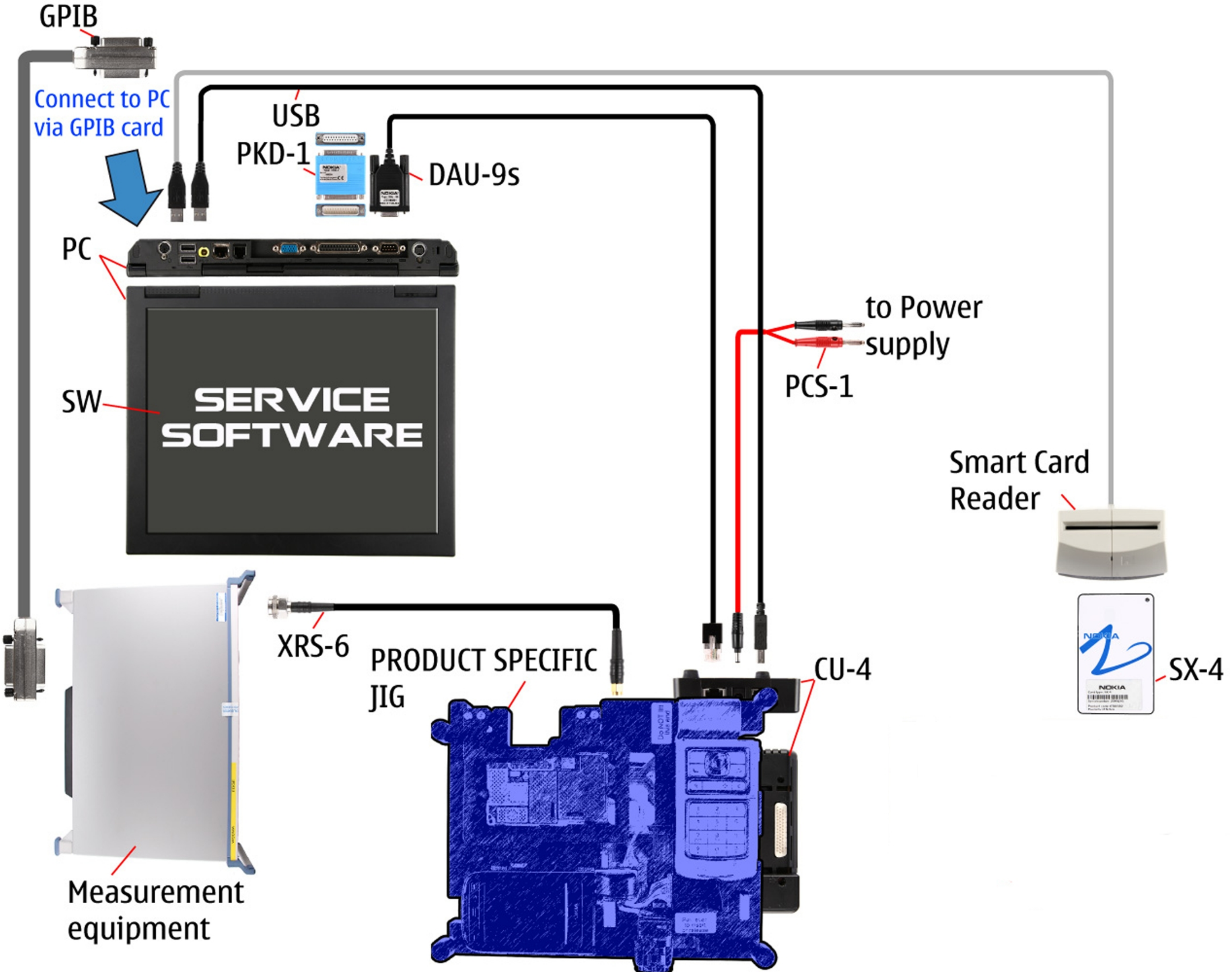

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
PRODUCT SPECIFIC JIG
CU-4
SX-4
Measurement equipment

Figure 11 Module jig service concept with SB-6

Type	Description
Product specific tools	
MJ-180	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box

Type	Description
SB-6	Bluetooth test and interface box
PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
CA-56RS	RF tuning cable
	GPIB control cable
	USB cable

RF testing concept with RF coupler

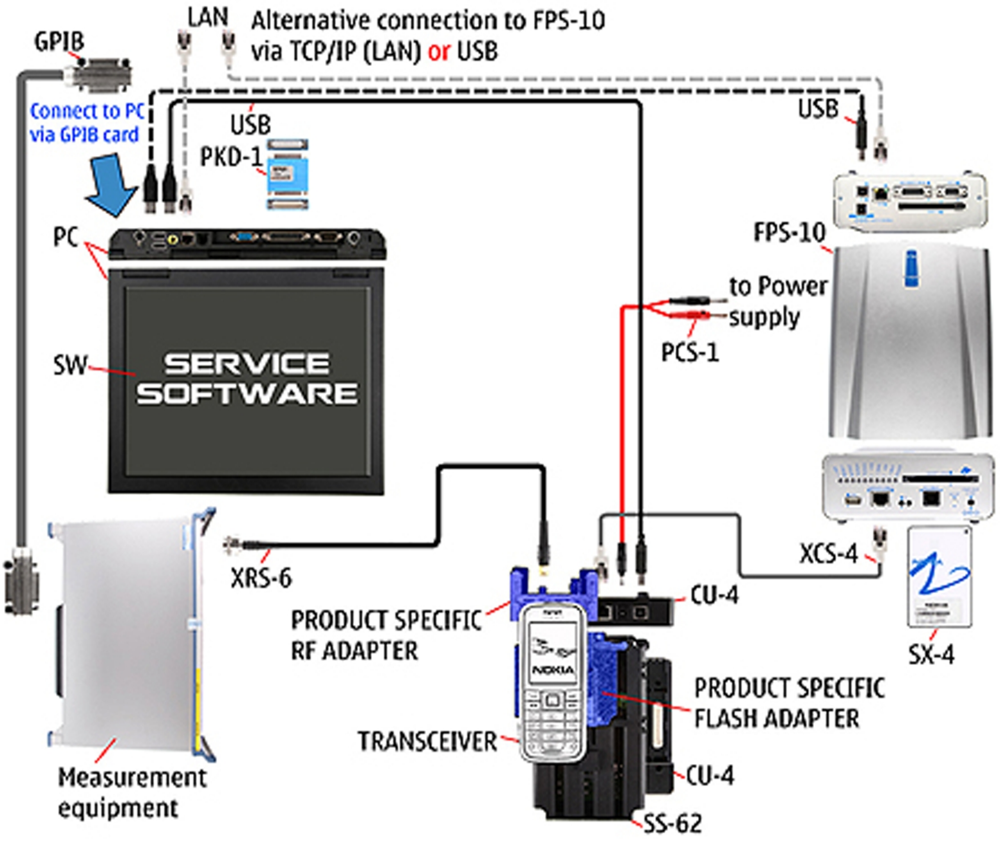

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC
RF ADAPTER
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement
equipment
SS-62

Figure 12 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-129	Flash adapter

Type	Description
SA-167	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

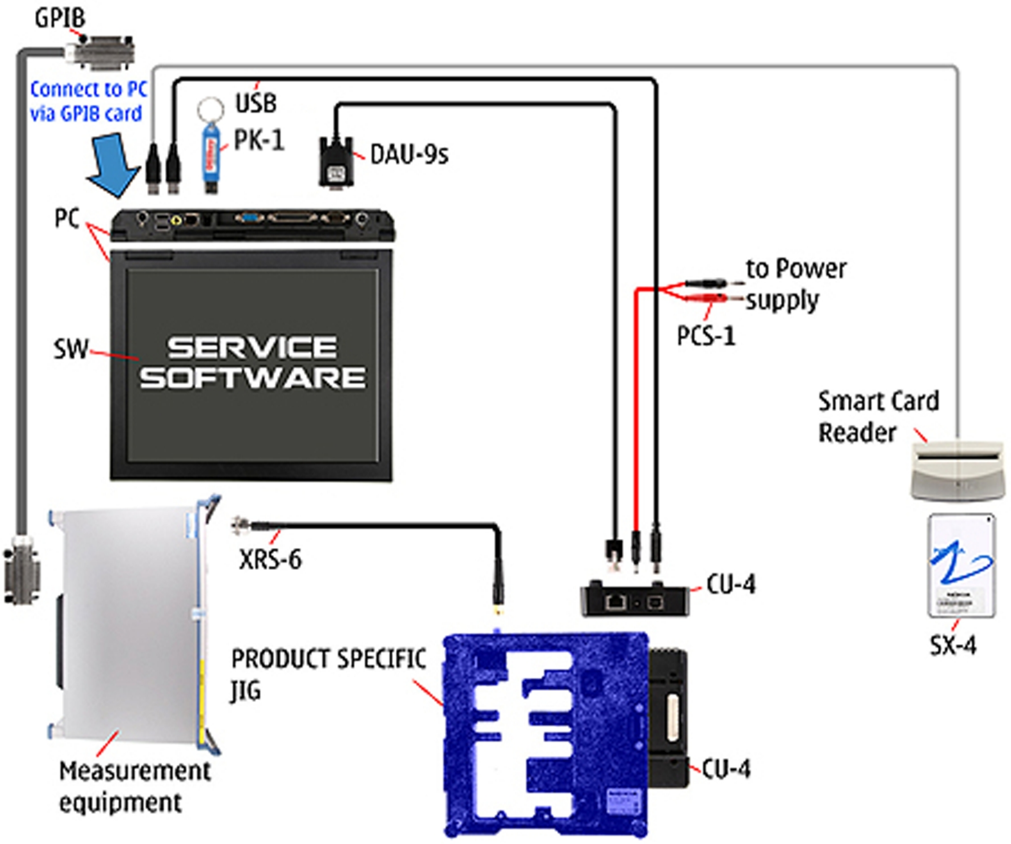

GPIB
Connect to PC via GPIB card
USB
PK-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 13 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-180	Module jig
Other devices	
CU-4	Control unit
PK-1/PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
CA-128RS	RF tuning cable
	GPIB control cable
	USB cable

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3 — BB Troubleshooting

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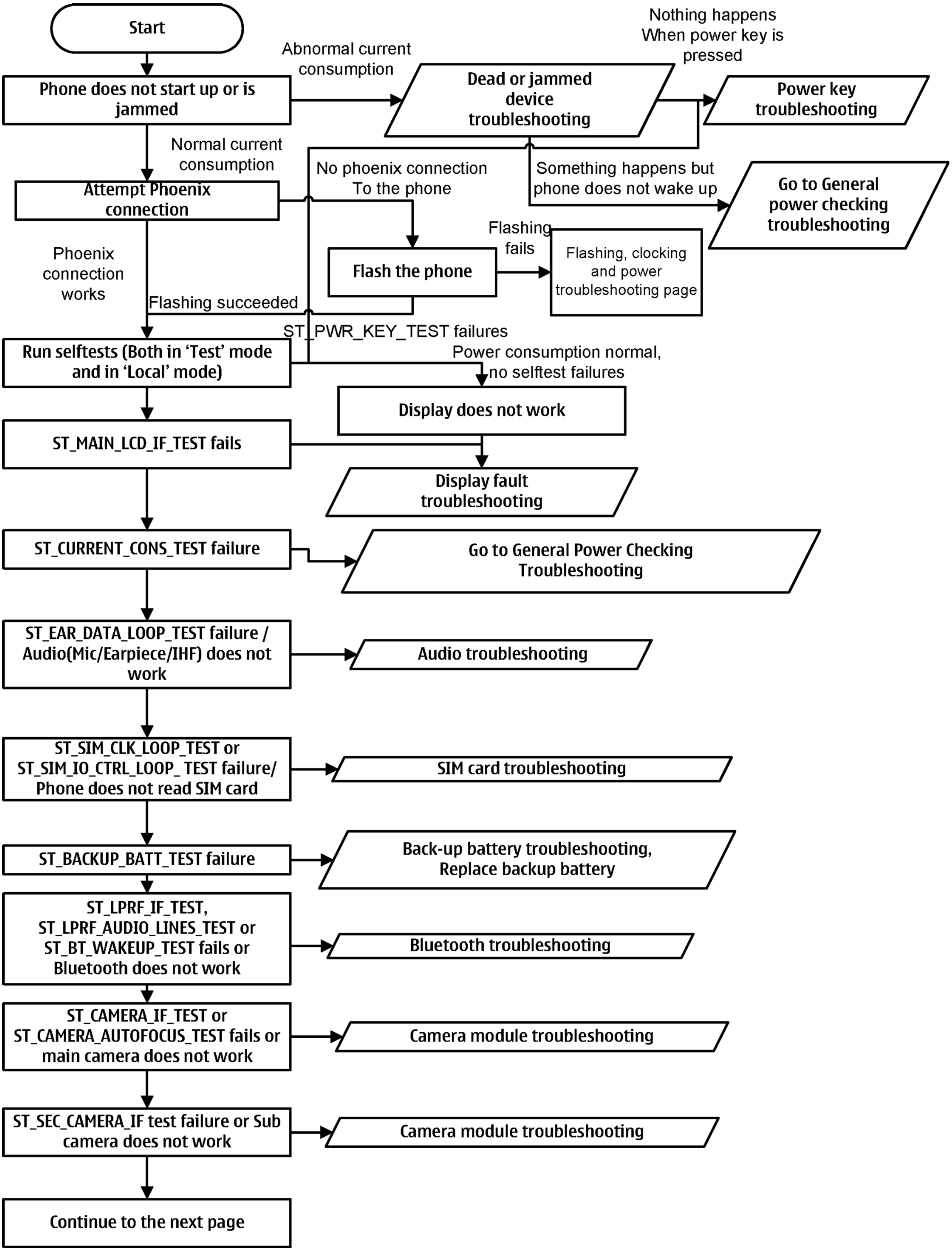
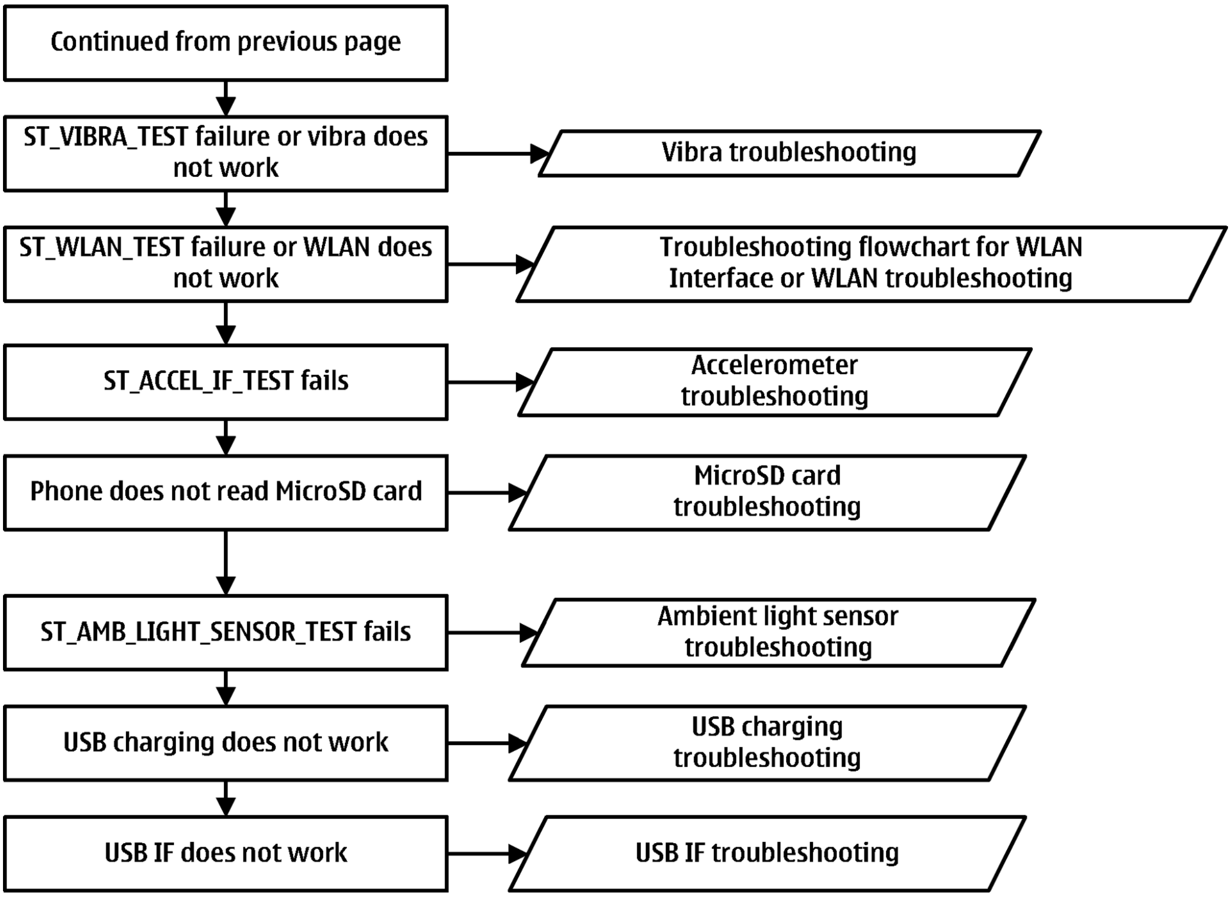
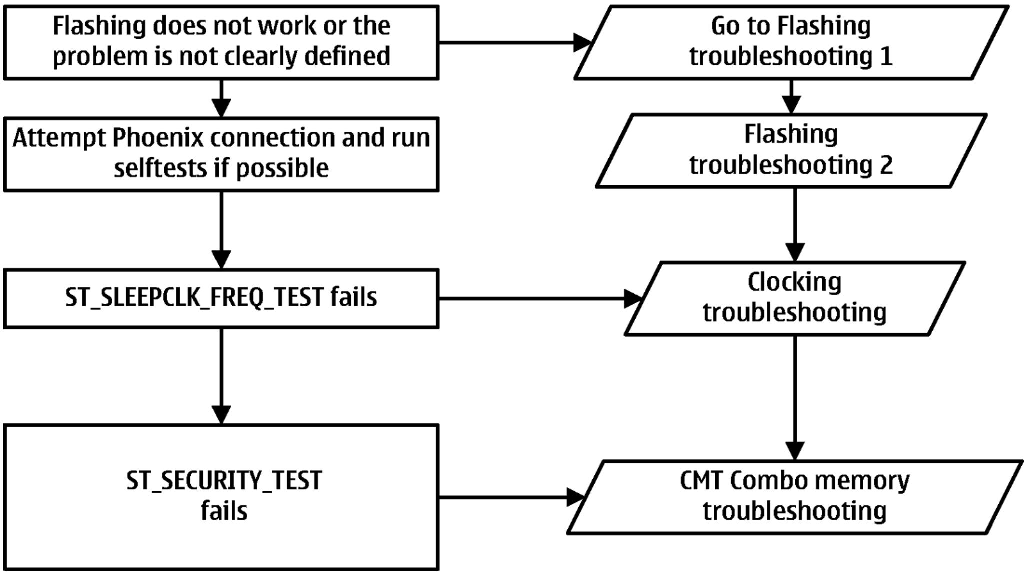
Baseband main troubleshooting

Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens When power key is pressed
Power key troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Something happens but phone does not wake up
Go to General power checking troubleshooting
Flashing fails
Flash the phone
Flashing, clocking and power troubleshooting page
Phoenix connection works
Flashing succeeded
ST_PWR_KEY_TEST failures
Run selftests (Both in 'Test' mode and in 'Local' mode)
Power consumption normal, no selftest failures
Display does not work
ST_MAIN_LCD_IF_TEST fails
Display fault troubleshooting
ST_CURRENT_CONS_TEST failure
Go to General Power Checking Troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Audio troubleshooting
ST_SIM_CLK_LOOP_TEST or ST_SIM_IO_CTRL_LOOP_ TEST failure/ Phone does not read SIM card
SIM card troubleshooting
ST_BACKUP_BATT_TEST failure
Back-up battery troubleshooting, Replace backup battery
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST or ST_BT_WAKEUP_TEST fails or Bluetooth does not work
Bluetooth troubleshooting
ST_CAMERA_IF_TEST or ST_CAMERA_AUTOFOCUS_TEST fails or main camera does not work
Camera module troubleshooting
ST_SEC_CAMERA_IF test failure or Sub camera does not work
Camera module troubleshooting
Continue to the next page


Continued from previous page
ST_VIBRA_TEST failure or vibra does not work
Vibra troubleshooting
ST_WLAN_TEST failure or WLAN does not work
Troubleshooting flowchart for WLAN Interface or WLAN troubleshooting
ST_ACCEL_IF_TEST fails
Accelerometer troubleshooting
Phone does not read MicroSD card
MicroSD card troubleshooting
ST_AMB_LIGHT_SENSOR_TEST fails
Ambient light sensor troubleshooting
USB charging does not work
USB charging troubleshooting
USB IF does not work
USB IF troubleshooting

Flashing, clocking and power troubleshooting


Flashing does not work or the problem is not clearly defined
Go to Flashing troubleshooting 1
Attempt Phoenix connection and run selftests if possible
Flashing troubleshooting 2
ST_SLEEPCLK_FREQ_TEST fails
Clocking troubleshooting
ST_SECURITY_TEST fails
CMT Combo memory troubleshooting

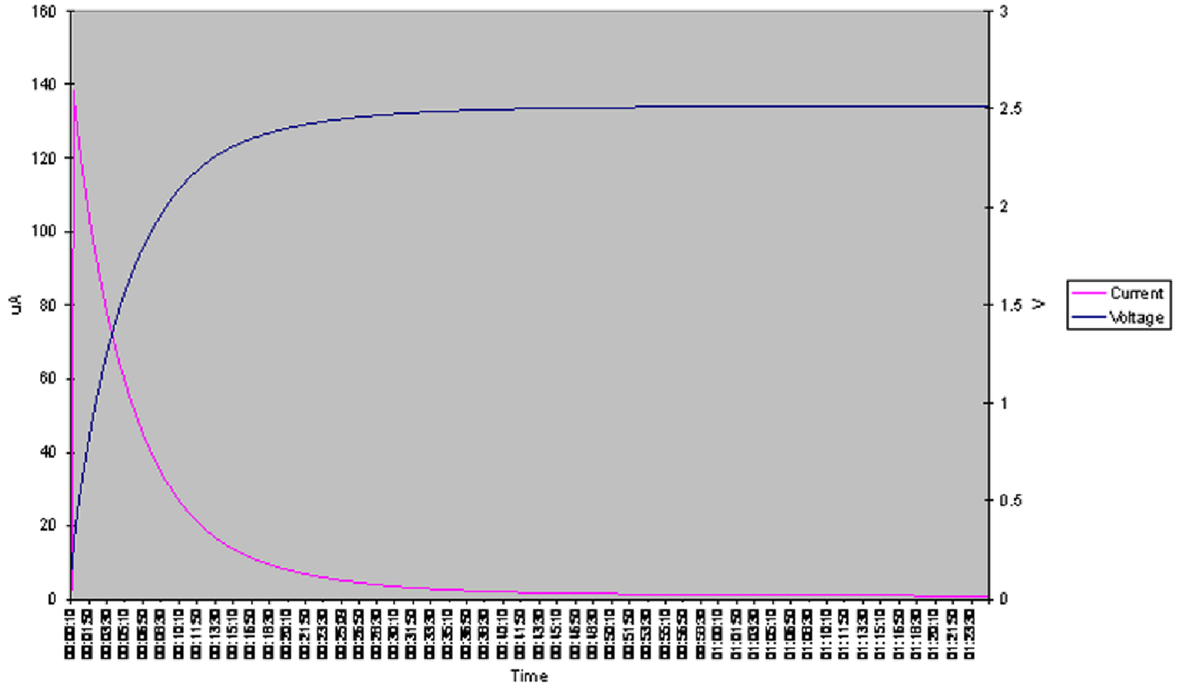
General power checking

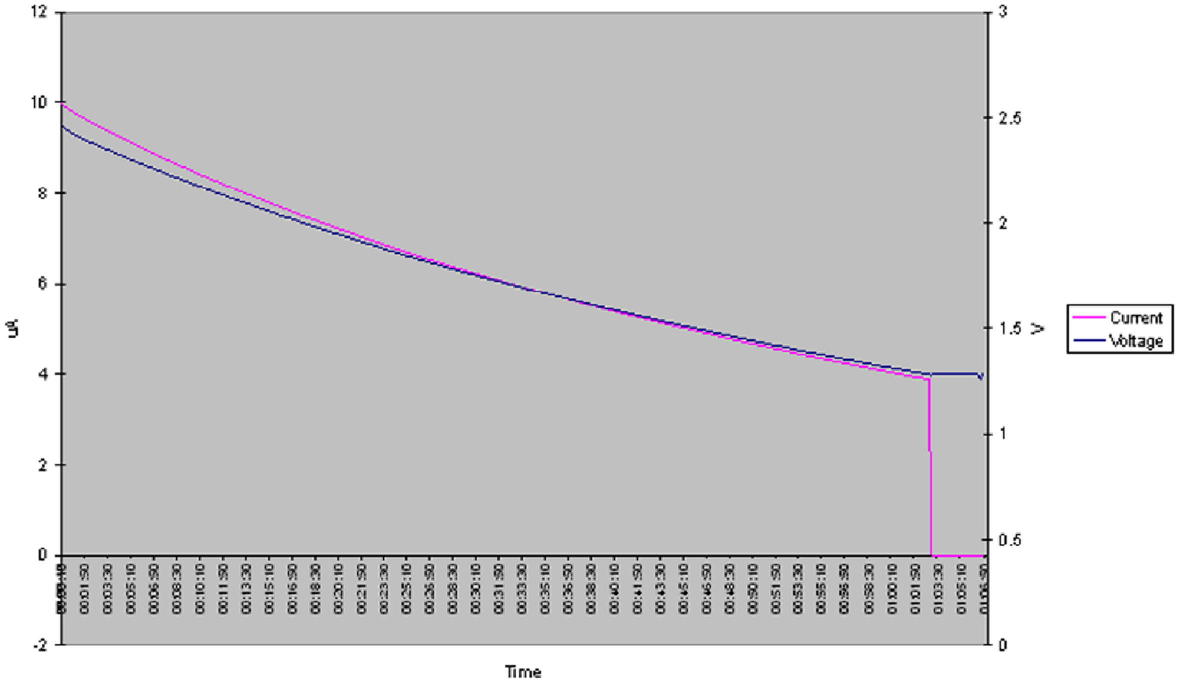
Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO_V	AVILMA	ON	ON	1.82	Not used	
VBACK	AVILMA	ON	ON	2.5	RTC circuitry	
VSIM1	AVILMA	ON	ON	1.8/3.0	Sim card	
VSIM2	AVILMA	ON	ON	3.0	Digital microphone	
VAUX	AVILMA	OFF	OFF	2.78	Accelerometer, Hall switches, 2nd camera	
VANA	AVILMA	ON	ON	2.5	Vilma internal	
VR1	AVILMA	OFF	ON	2.5	VCTXO	
VRFC	AVILMA	ON	OFF	1.8	RAPIDO converter	
VRCP1	AVILMA	OFF	OFF	4.75	RFmodule	RF active
VIO	LM3677	ON	ON	1.8	Rapido , Betty I/O	
VDRAM	LM3677	ON	ON	1.8	M3 Memory	
VCORE	TPS62350	ON	ON	1.2	Rapido core	
VDAC	LP3985			3.0	DAC33	On when used
VCAM_1V8	LM3677	OFF	OFF	1.8	Julie, LP5952	
VCAM_1V3		OFF	OFF	1.3	Julie,core	
VCAM_2V8		OFF	OFF	2.8	Main camera	
VSD	LP3930	OFF	OFF	2.9	SD card	On when used
V_ELVDD	TPS65136	OFF	OFF	4.6	Falcon OLED Display	
V_ELVSS	TPS65136	OFF	OFF	-4.9	Falcon OLED Display	
VCORE_WD	LP5952	OFF	OFF	1.5	White Dwarf Core	
VBAT				3.6		
VCORE	BETTY	OFF	OFF	1.2	Not used	
VDRAM_V	AVILMA		ON	1.82	Not used	
VLED	BETTY			6-18	Not used	

Backup battery troubleshooting

Verify that the backup battery G2200 is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on. Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below:

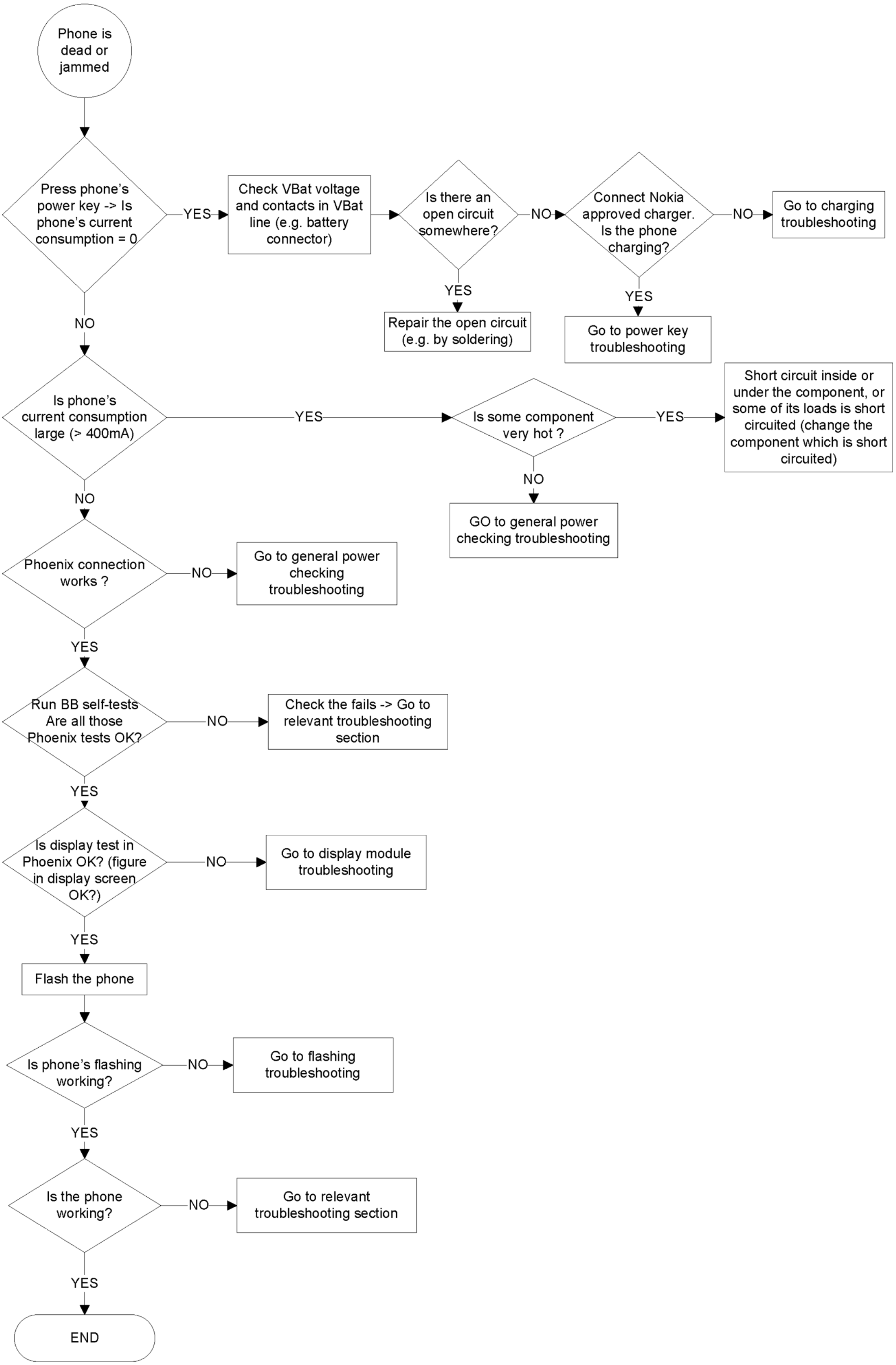




If the voltage rises and falls quickly, check the back-up battery G2200 contacts for loose soldering or short-circuit, and repair or change G2200 if necessary. If the voltage stays ~0V, check resistance VBACK against GND. If there is no shortcircuit, AVILMA N2200 is faulty. Replace N2200.

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check VBat voltage and contacts in VBat line (e.g. battery connector)
Is there an open circuit somewhere?
NO
Connect Nokia approved charger. Is the phone charging?
NO
Go to charging troubleshooting
YES
Repair the open circuit (e.g. by soldering)
YES
Go to power key troubleshooting
NO
Is phone's current consumption large (> 400mA)
YES
Is some component very hot ?
YES
Short circuit inside or under the component, or some of its loads is short circuited (change the component which is short circuited)
NO
GO to general power checking troubleshooting
NO
Phoenix connection works ?
NO
Go to general power checking troubleshooting
YES
Run BB self-tests Are all those Phoenix tests OK?
NO
Check the fails -> Go to relevant troubleshooting section
YES
Is display test in Phoenix OK? (figure in display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to flashing troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
END

Keyboard troubleshooting

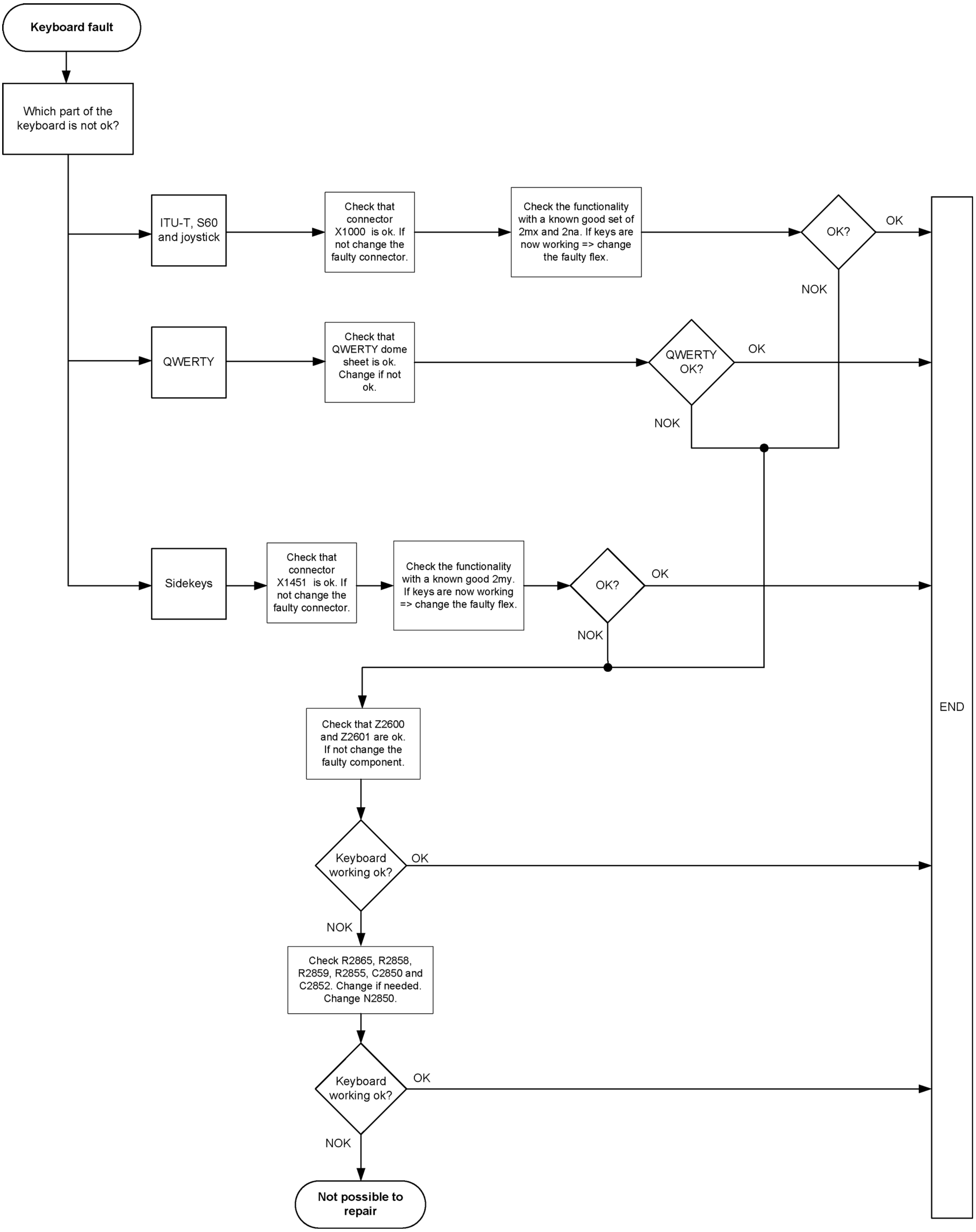
Context

There are two possible failure modes in the keyboard module:

1. One or more keys are stuck, so that the key(s) does not react when you press a keydome. This kind of failure is caused by mechanical reasons (dirt, corrosion).
2. Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section **Keyboard**.

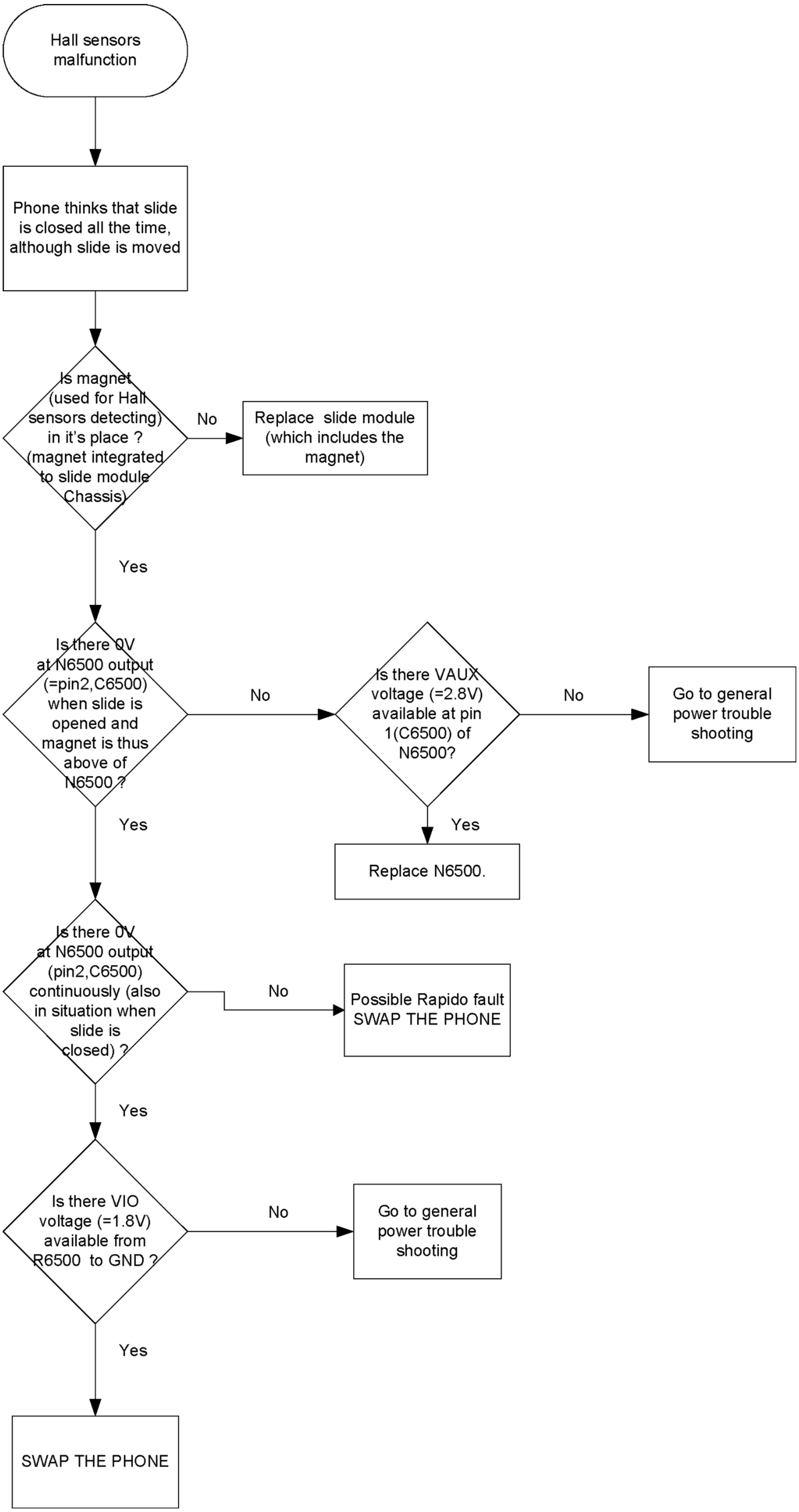
If the failure mode is not clear, start with the **Keyboard Test** in *Phoenix*.

Troubleshooting flow


Keyboard fault
Which part of the keyboard is not ok?
ITU-T, S60 and joystick
Check that connector X1000 is ok. If not change the faulty connector.
Check the functionality with a known good set of 2mx and 2na. If keys are now working => change the faulty flex.
OK?
OK
NOK
QWERTY
Check that QWERTY dome sheet is ok. Change if not ok.
QWERTY OK?
OK
NOK
Sidekeys
Check that connector X1451 is ok. If not change the faulty connector.
Check the functionality with a known good 2my. If keys are now working => change the faulty flex.
OK?
OK
NOK
Check that Z2600 and Z2601 are ok. If not change the faulty component.
Keyboard working ok?
OK
NOK
Check R2865, R2858, R2859, R2855, C2850 and C2852. Change if needed. Change N2850.
Keyboard working ok?
OK
NOK
Not possible to repair
END

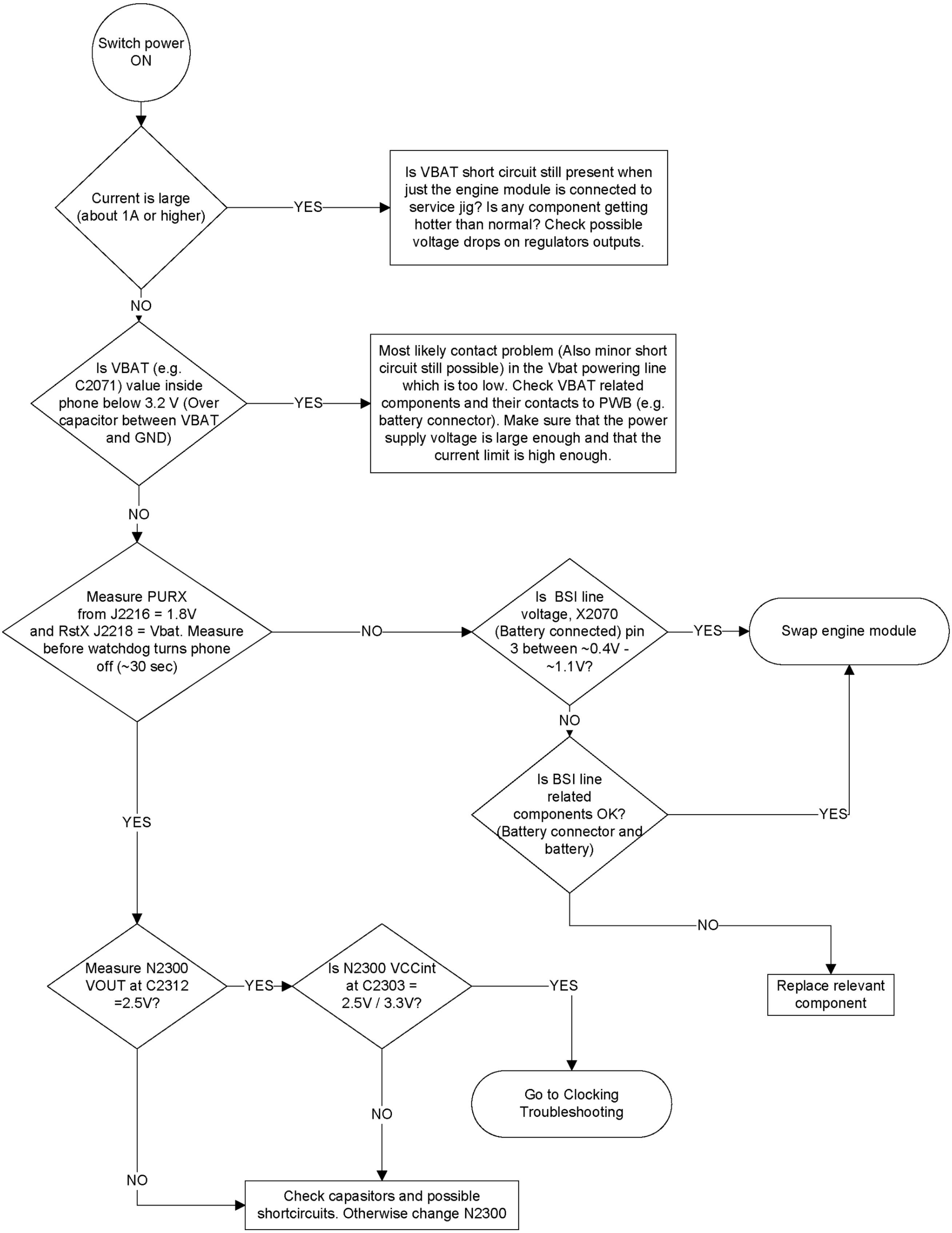
Hall sensor troubleshooting

Troubleshooting flow


Hall sensors malfunction
Phone thinks that slide is closed all the time, although slide is moved
Is magnet (used for Hall sensors detecting) in it's place ? (magnet integrated to slide module Chassis)
No
Replace slide module (which includes the magnet)
Yes
Is there 0V at N6500 output (=pin2,C6500) when slide is opened and magnet is thus above of N6500 ?
No
Is there VAUX voltage (=2.8V) available at pin 1(C6500) of N6500?
No
Go to general power trouble shooting
Yes
Replace N6500.
Yes
Is there 0V at N6500 output (pin2,C6500) continuously (also in situation when slide is closed) ?
No
Possible Rapido fault SWAP THE PHONE
Yes
Is there VIO voltage (=1.8V) available from R6500 to GND ?
No
Go to general power trouble shooting
Yes
SWAP THE PHONE

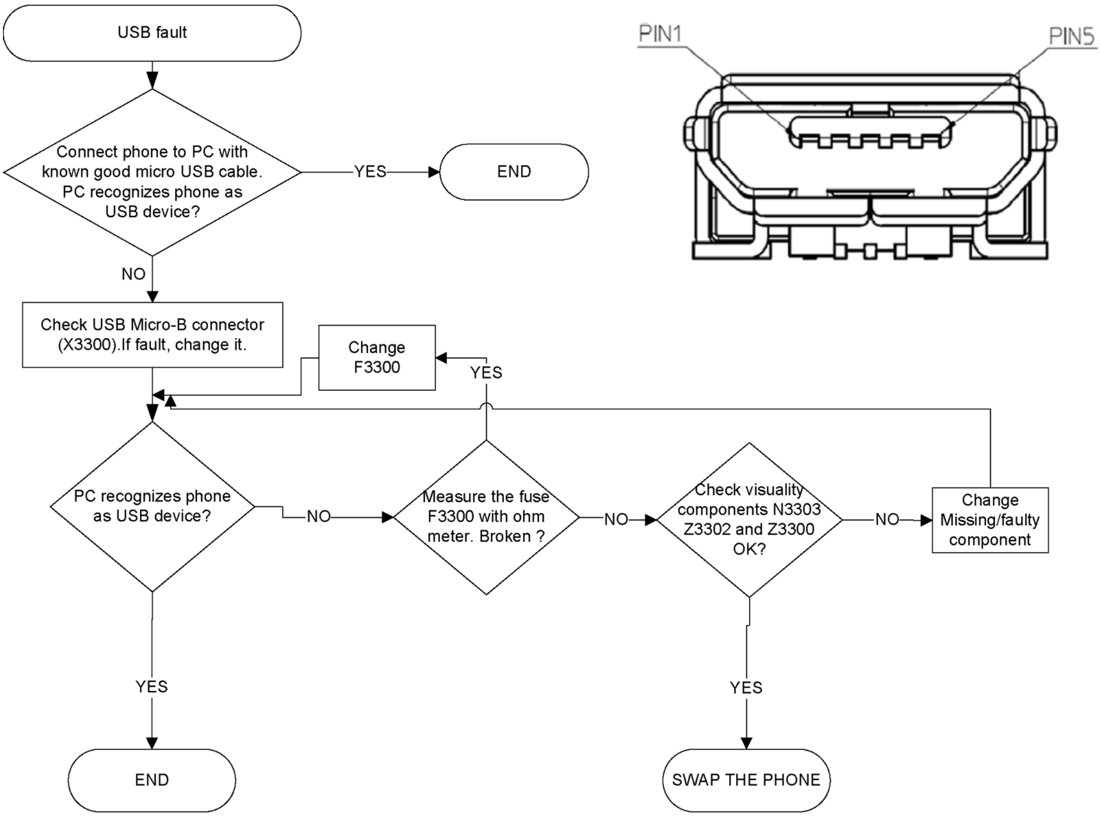
General power checking troubleshooting

Troubleshooting flow


Switch power ON
Current is large (about 1A or higher)
YES
Is VBAT short circuit still present when just the engine module is connected to service jig? Is any component getting hotter than normal? Check possible voltage drops on regulators outputs.
NO
Is VBAT (e.g. C2071) value inside phone below 3.2 V (Over capacitor between VBAT and GND)
YES
Most likely contact problem (Also minor short circuit still possible) in the Vbat powering line which is too low. Check VBAT related components and their contacts to PWB (e.g. battery connector). Make sure that the power supply voltage is large enough and that the current limit is high enough.
NO
Measure PURX from J2216 = 1.8V and RstX J2218 = Vbat. Measure before watchdog turns phone off (~30 sec)
NO
Is BSI line voltage, X2070 (Battery connected) pin 3 between ~0.4V - ~1.1V?
YES
Swap engine module
NO
Is BSI line related components OK? (Battery connector and battery)
YES
NO
Replace relevant component
YES
Measure N2300 VOUT at C2312 =2.5V?
YES
Is N2300 VCCint at C2303 = 2.5V / 3.3V?
YES
Go to Clocking Troubleshooting
NO
NO
Check capasitors and possible shortcircuits. Otherwise change N2300

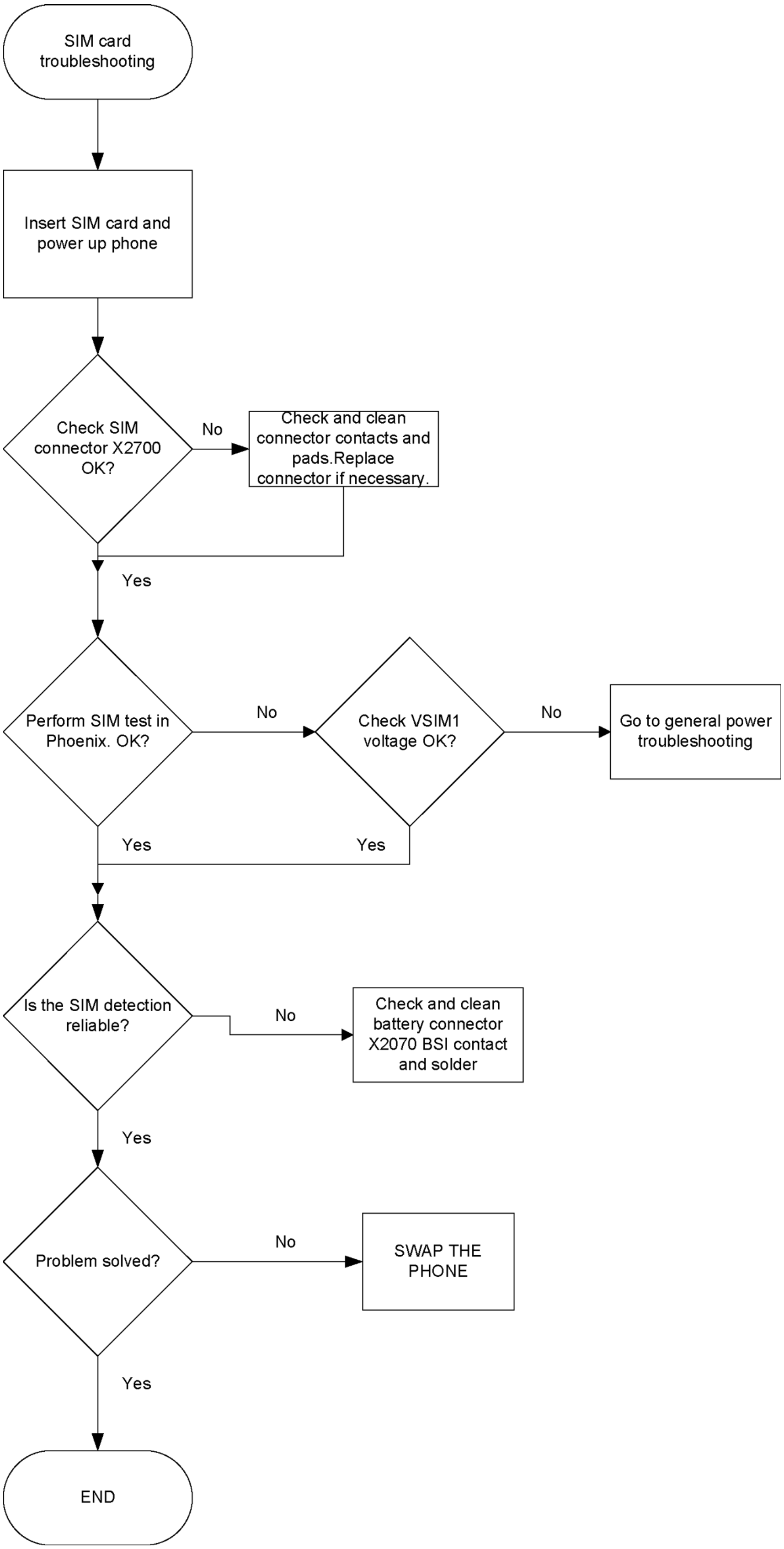
USB troubleshooting

Troubleshooting flow


USB fault
Connect phone to PC with known good micro USB cable. PC recognizes phone as USB device?
YES
END
NO
Check USB Micro-B connector (X3300).If fault, change it.
Change F3300
YES
PC recognizes phone as USB device?
NO
Measure the fuse F3300 with ohm meter. Broken ?
NO
Check visuality components N3303 Z3302 and Z3300 OK?
NO
Change Missing/faulty component
YES
END
YES
SWAP THE PHONE
PIN1
PIN5

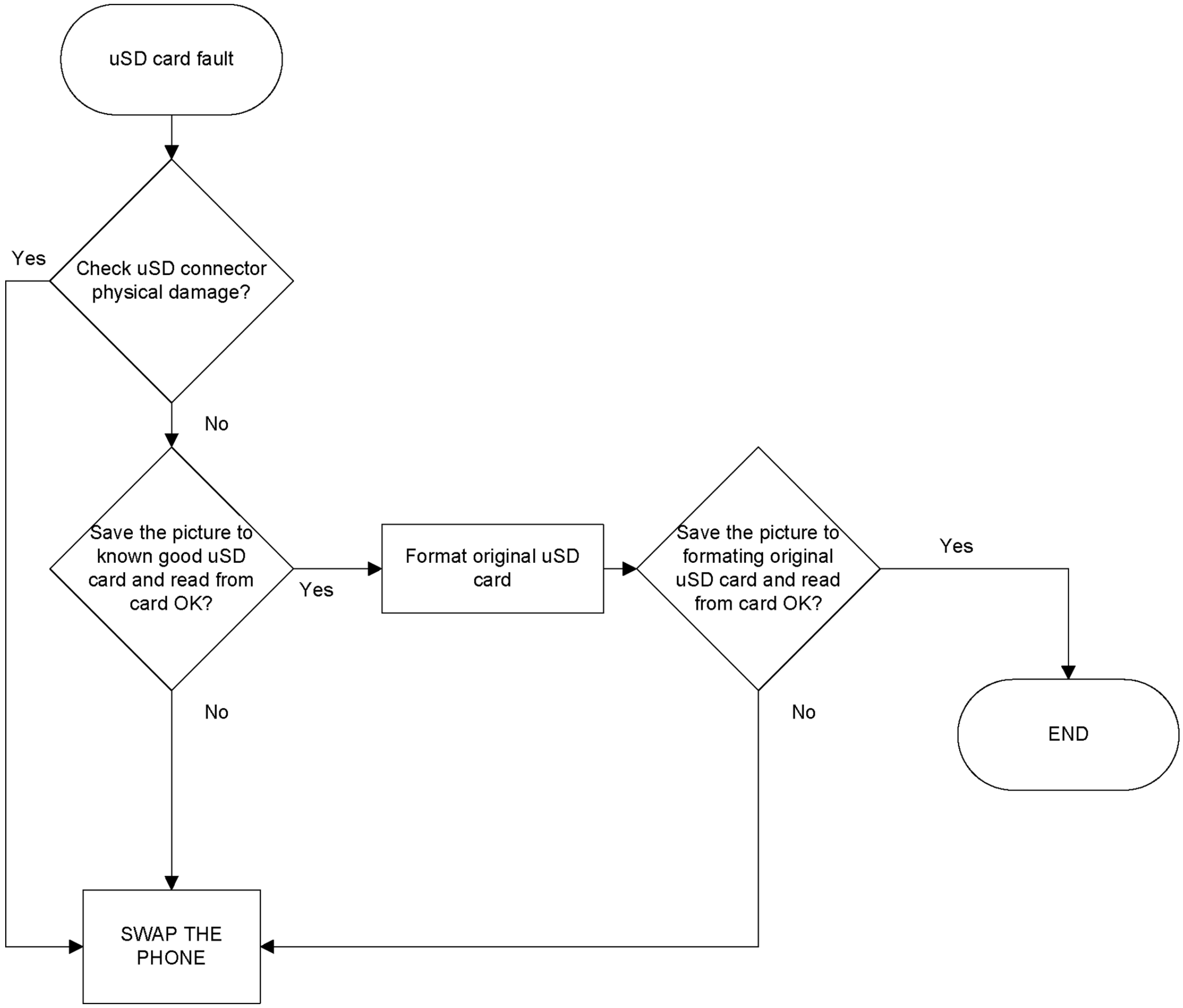
SIM card troubleshooting

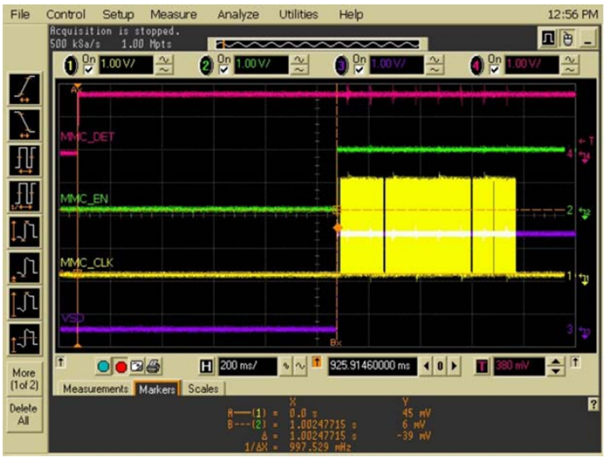
Troubleshooting flow


SIM card troubleshooting
Insert SIM card and power up phone
Check SIM connector X2700 OK?
No
Check and clean connector contacts and pads.Replace connector if necessary.
Yes
Perform SIM test in Phoenix. OK?
No
Check VSIM1 voltage OK?
No
Go to general power troubleshooting
Yes
Yes
Is the SIM detection reliable?
No
Check and clean battery connector X2070 BSI contact and solder
Yes
Problem solved?
No
SWAP THE PHONE
Yes
END

MicroSD card troubleshooting

Troubleshooting flow

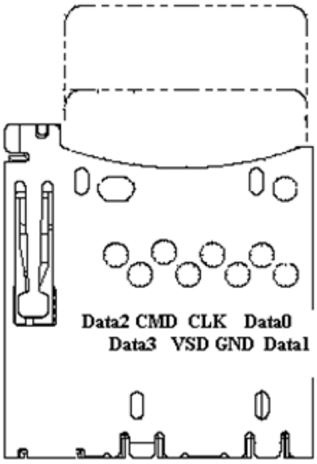

uSD card fault
Check uSD connector physical damage?
Yes
No
Save the picture to known good uSD card and read from card OK?
Yes
No
Format original uSD card
Save the picture to formating original uSD card and read from card OK?
Yes
No
END
SWAP THE PHONE


File
Control
Setup
Measure
Analyze
Utilities
Help
12:56 PM
1.00 V/
MMC_DET
MMC_EN
MMC_CLK
VSD
200 ms/
925.91460000 ms
380 mV
Measurements
Markers
Scales
More (1 of 2)
Delete All

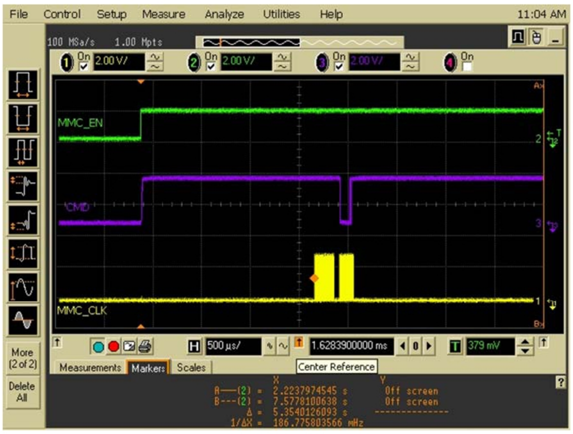
```
Acquisition is stopped.
500 kSa/s    1.00 Mpts
```

```
                X                  Y
A——(1) =   0.0 s                45 mV
B---(2) =   1.00247715 s          6 mV
     Δ =   1.00247715 s         -39 mV
  1/ΔX =   997.529 mHz
```

MicroSD interface signals timing when card is inserted.


Data2
CMD
CLK
Data0
Data3
VSD
GND
Data1

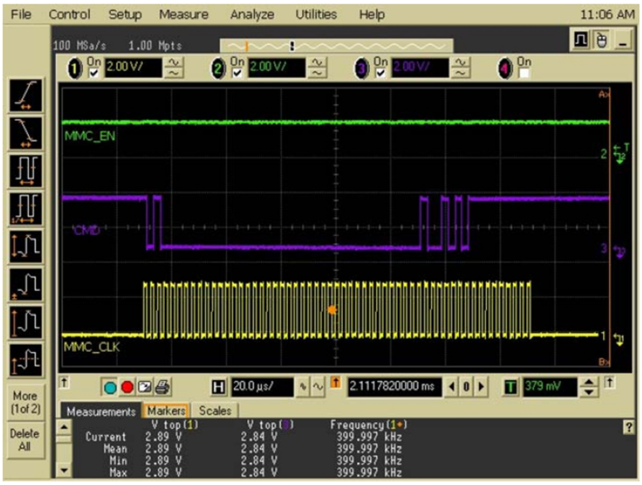
MicroSD connector


File
Control
Setup
Measure
Analyze
Utilities
Help
11:04 AM
2.00 V/
MMC_EN
CMD
MMC_CLK
500 µs/
1.6283900000 ms
379 mV
Center Reference
Measurements
Markers
Scales
More (2 of 2)
Delete All

```
100 MSa/s    1.00 Mpts
```

```
                X                   Y
A——(2) =   2.2237974545 s     Off screen
B---(2) =   7.5778100638 s     Off screen
     Δ =   5.3540126093 s    ---------------
  1/ΔX =   186.775803566 mHz
```

CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector.


File
Control
Setup
Measure
Analyze
Utilities
Help
11:06 AM
2.00 V/
MMC_EN
CMD
MMC_CLK
20.0 µs/
2.1117820000 ms
379 mV
Measurements
Markers
Scales
More (1 of 2)
Delete All

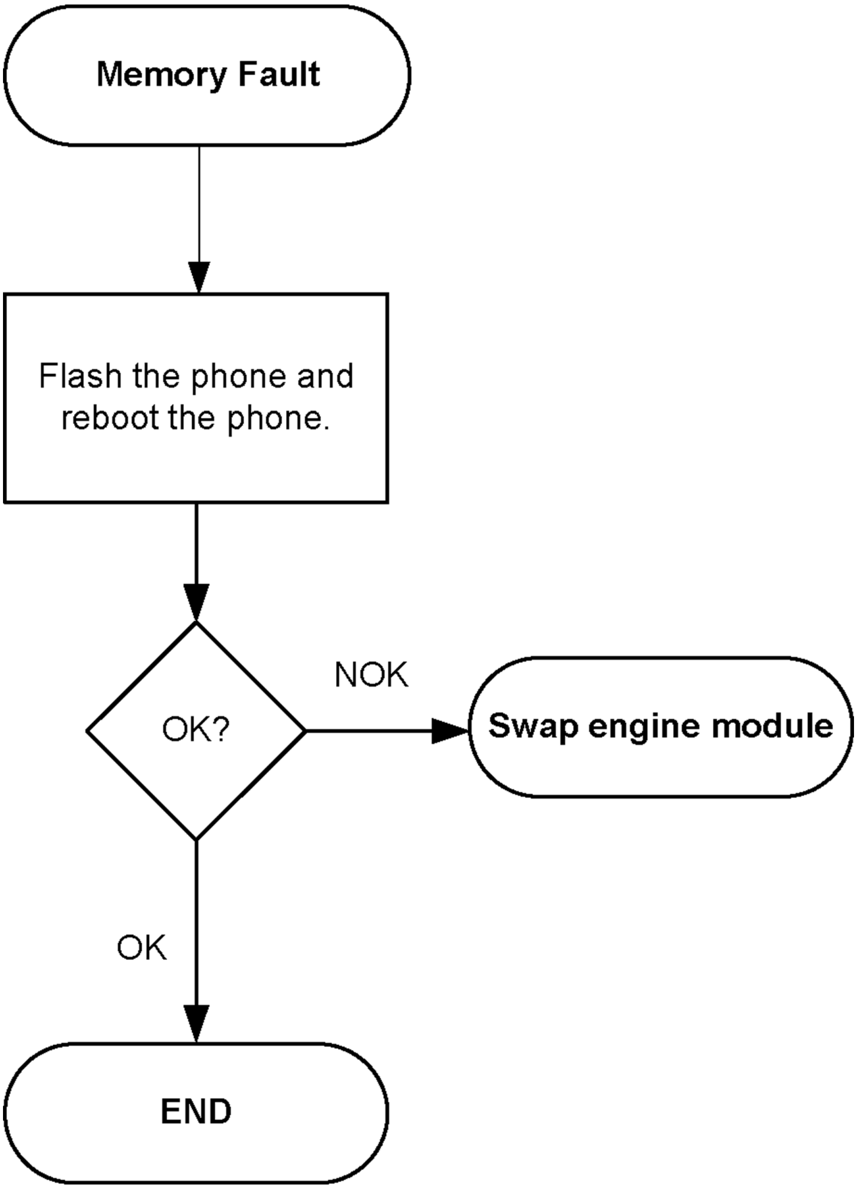
```
100 MSa/s    1.00 Mpts
```

```
          V top(1)       V top(3)       Frequency(1↑)
Current   2.89 V         2.84 V         399.997 kHz
   Mean   2.89 V         2.84 V         399.997 kHz
    Min   2.89 V         2.84 V         399.997 kHz
    Max   2.89 V         2.84 V         399.997 kHz
```

CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector

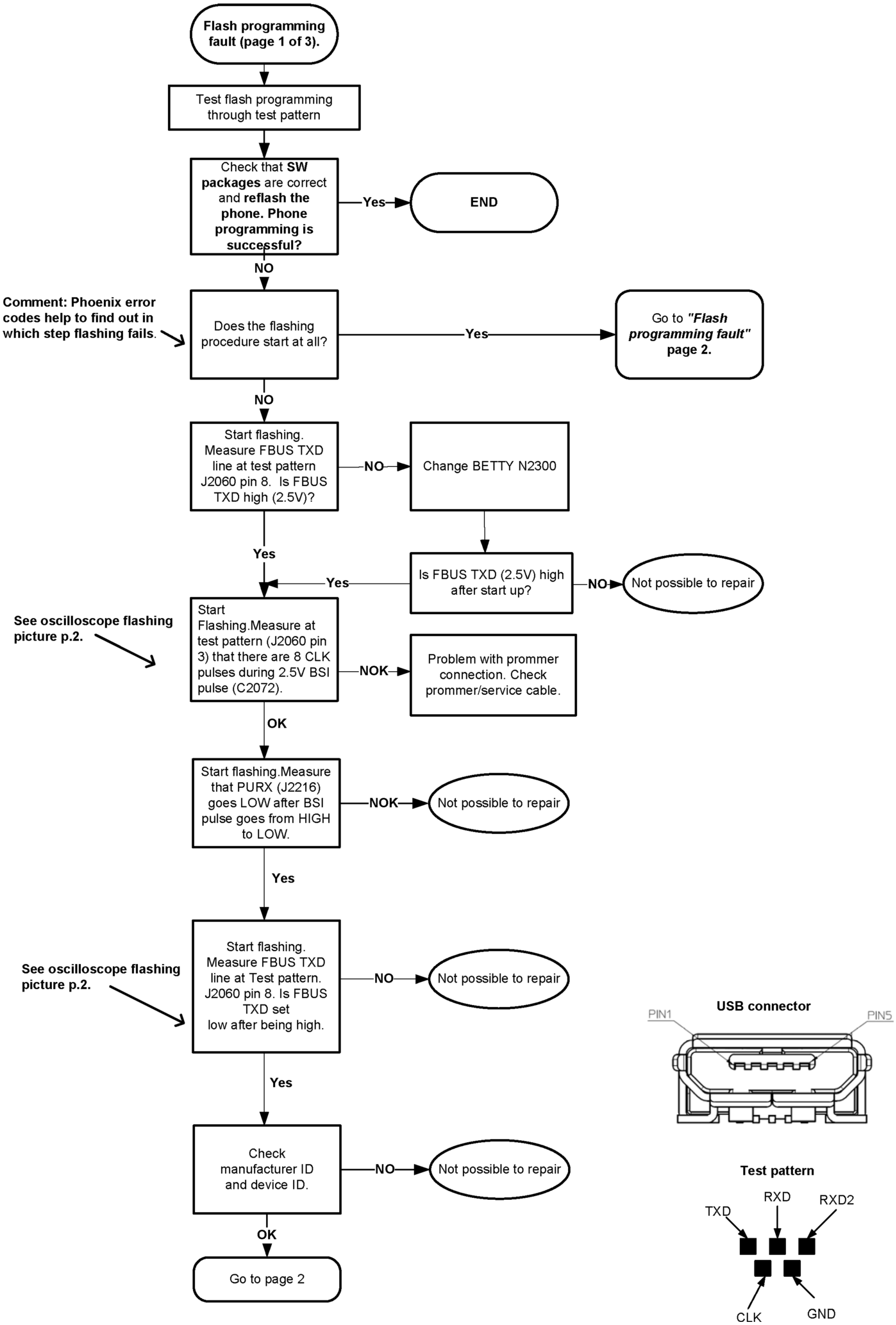
Combo memory troubleshooting

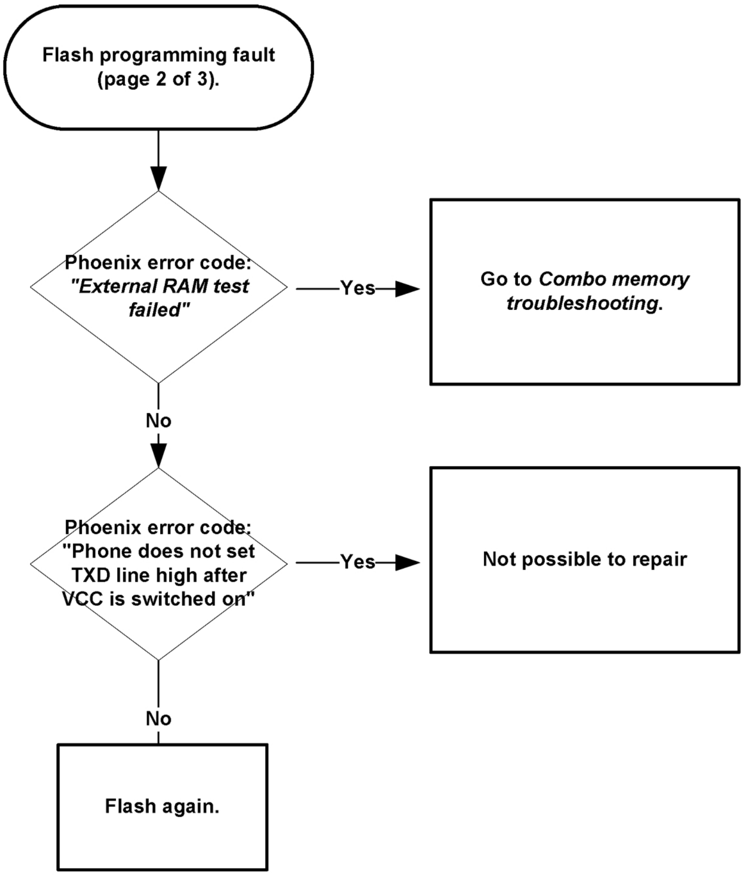
Troubleshooting flow

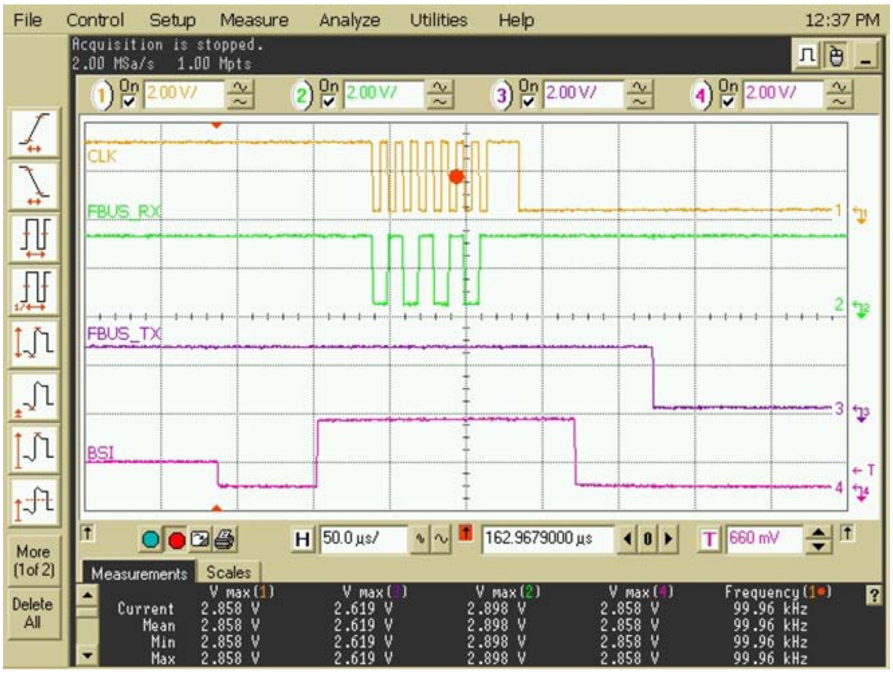

Memory Fault
Flash the phone and reboot the phone.
OK?
NOK
Swap engine module
OK
END

Flash programming troubleshooting

Troubleshooting flow

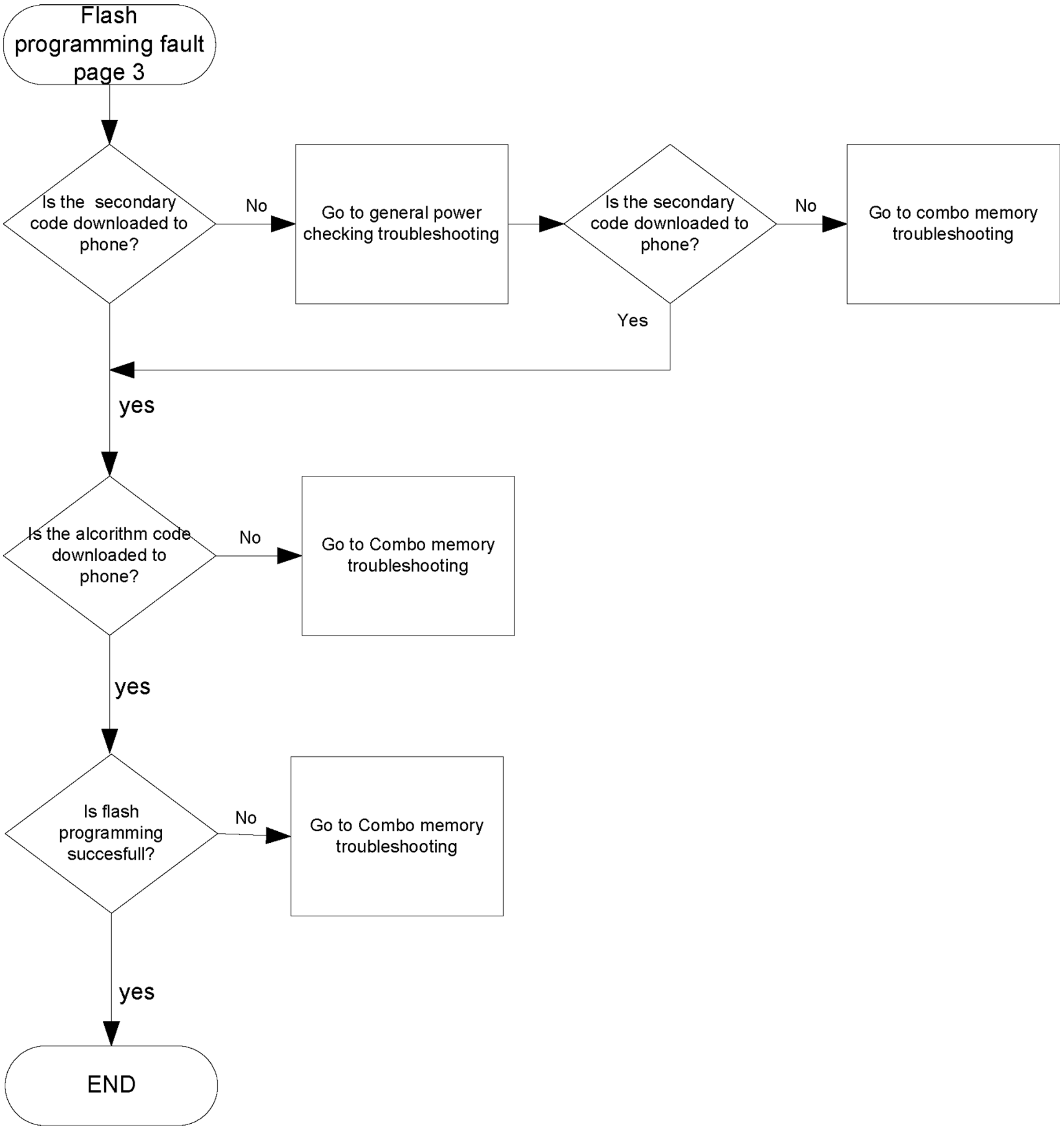

Flash programming fault (page 1 of 3).
Test flash programming through test pattern
Check that SW packages are correct and reflash the phone. Phone programming is successful?
Yes
END
NO
Comment: Phoenix error codes help to find out in which step flashing fails.
Does the flashing procedure start at all?
Yes
Go to "Flash programming fault" page 2.
NO
Start flashing. Measure FBUS TXD line at test pattern J2060 pin 8. Is FBUS TXD high (2.5V)?
NO
Change BETTY N2300
Is FBUS TXD (2.5V) high after start up?
NO
Not possible to repair
Yes
Yes
See oscilloscope flashing picture p.2.
Start Flashing.Measure at test pattern (J2060 pin 3) that there are 8 CLK pulses during 2.5V BSI pulse (C2072).
NOK
Problem with prommer connection. Check prommer/service cable.
OK
Start flashing.Measure that PURX (J2216) goes LOW after BSI pulse goes from HIGH to LOW.
NOK
Not possible to repair
Yes
See oscilloscope flashing picture p.2.
Start flashing. Measure FBUS TXD line at Test pattern. J2060 pin 8. Is FBUS TXD set low after being high.
NO
Not possible to repair
Yes
Check manufacturer ID and device ID.
NO
Not possible to repair
OK
Go to page 2
USB connector
PIN1
PIN5
Test pattern
TXD
RXD
RXD2
CLK
GND


Flash programming fault (page 2 of 3).
Phoenix error code: *"External RAM test failed"*
Yes
Go to *Combo memory troubleshooting.*
No
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
Yes
Not possible to repair
No
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
12:37 PM
1 On 2.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On 2.00 V/
CLK
FBUS_RX
FBUS_TX
BSI
1
2
3
4
T
More (1of 2)
Delete All
H 50.0 µs/
162.9679000 µs
0
T 660 mV
Measurements
Scales

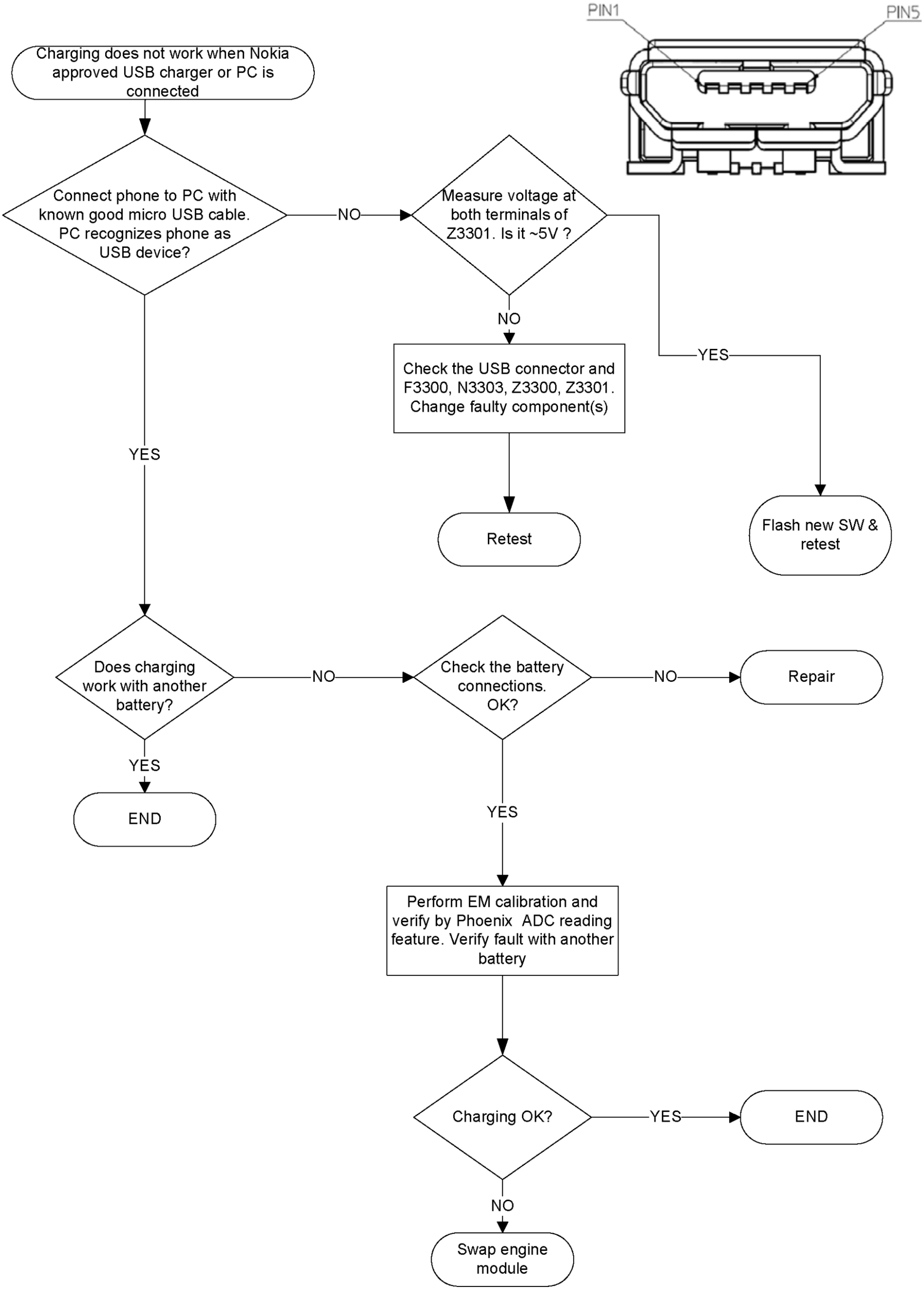
```
Acquisition is stopped.
2.00 MSa/s   1.00 Mpts
```

```
           V max(1)    V max( )    V max(2)    V max(4)    Frequency(1•)
Current    2.858 V     2.619 V     2.898 V     2.858 V     99.96 kHz
   Mean    2.858 V     2.619 V     2.898 V     2.858 V     99.96 kHz
    Min    2.858 V     2.619 V     2.898 V     2.858 V     99.96 kHz
    Max    2.858 V     2.619 V     2.898 V     2.858 V     99.96 kHz
```


Flash programming fault page 3
Is the secondary code downloaded to phone?
No
Go to general power checking troubleshooting
Is the secondary code downloaded to phone?
No
Go to combo memory troubleshooting
Yes
yes
Is the alcorithm code downloaded to phone?
No
Go to Combo memory troubleshooting
yes
Is flash programming succesfull?
No
Go to Combo memory troubleshooting
yes
END

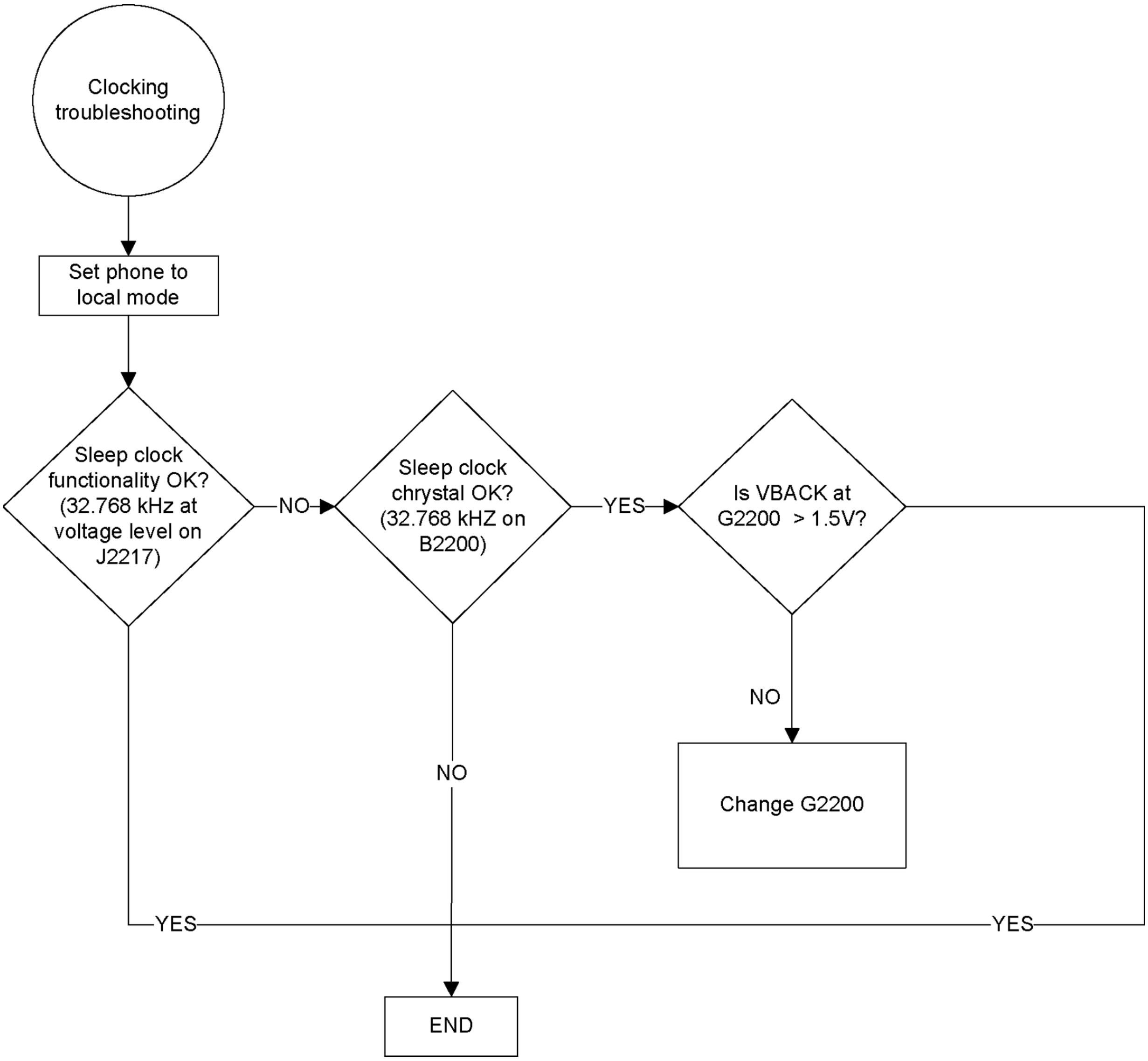
USB charging troubleshooting

Troubleshooting flow


PIN1
PIN5
Charging does not work when Nokia approved USB charger or PC is connected
Connect phone to PC with known good micro USB cable. PC recognizes phone as USB device?
NO
Measure voltage at both terminals of Z3301. Is it ~5V ?
NO
Check the USB connector and F3300, N3303, Z3300, Z3301. Change faulty component(s)
Retest
YES
Flash new SW & retest
YES
Does charging work with another battery?
NO
Check the battery connections. OK?
NO
Repair
YES
END
YES
Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery
Charging OK?
YES
END
NO
Swap engine module

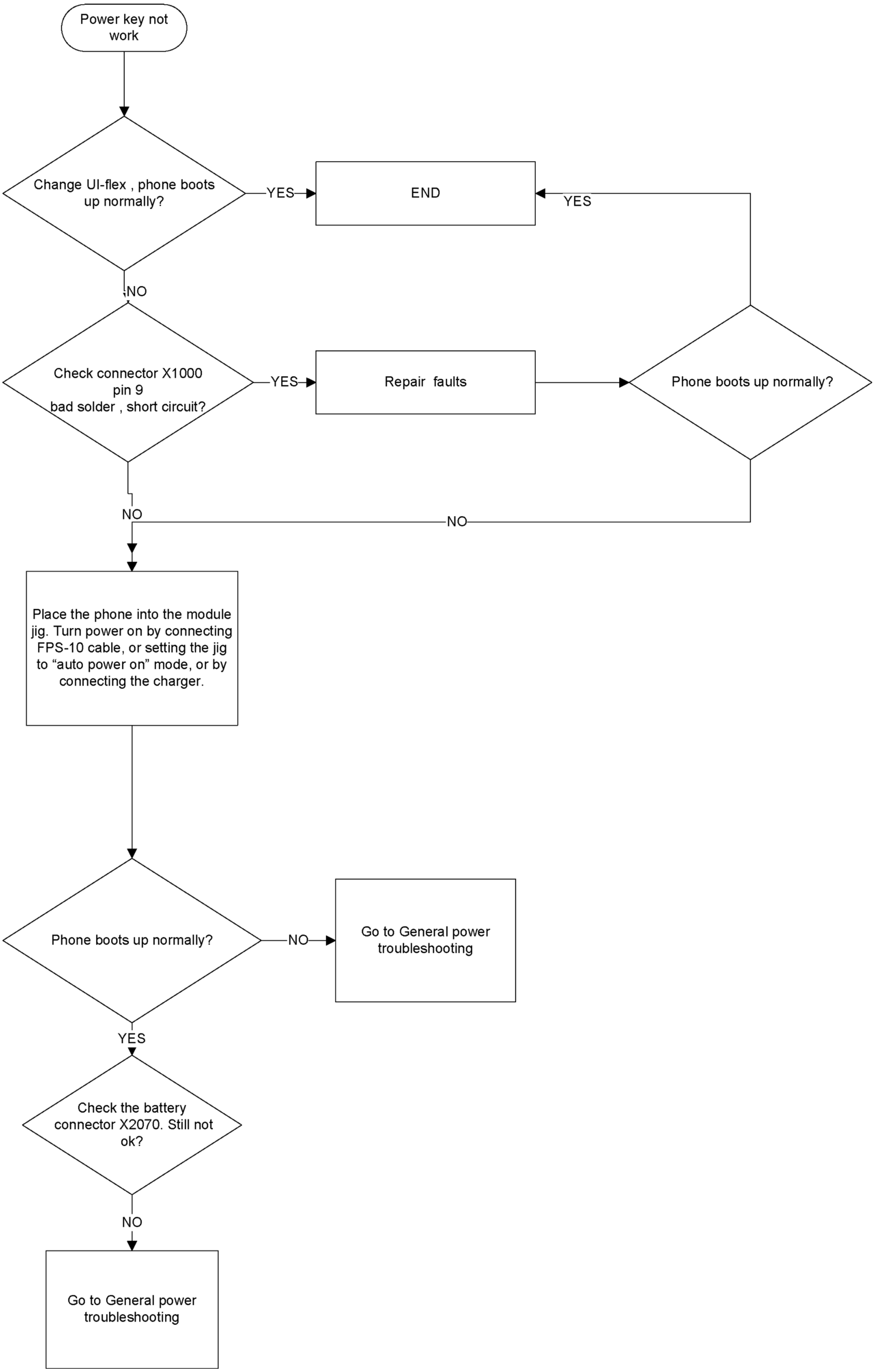
Clocking troubleshooting

Troubleshooting flow


Clocking troubleshooting
Set phone to local mode
Sleep clock functionality OK? (32.768 kHz at voltage level on J2217)
NO
Sleep clock chrystal OK? (32.768 kHZ on B2200)
YES
Is VBACK at G2200 > 1.5V?
NO
Change G2200
NO
YES
YES
END

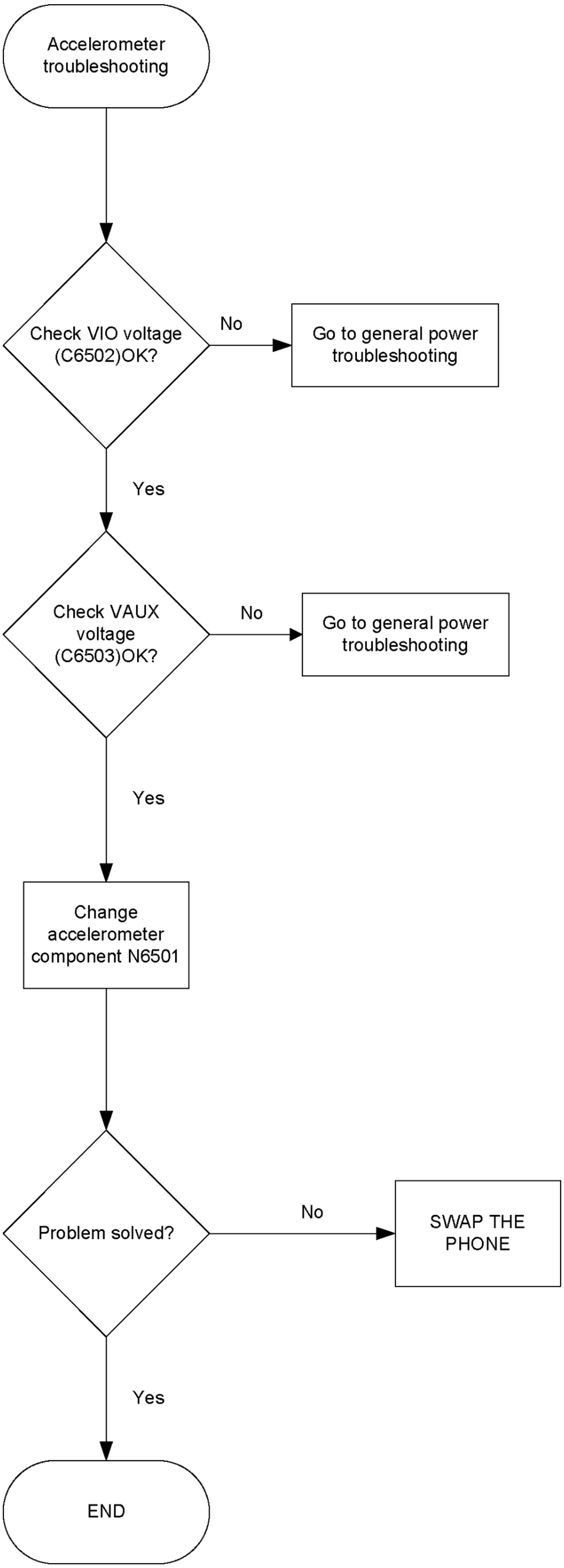
Power key troubleshooting

Troubleshooting flow


Power key not work
Change UI-flex , phone boots up normally?
YES
END
YES
NO
Check connector X1000 pin 9 bad solder , short circuit?
YES
Repair faults
Phone boots up normally?
NO
NO
Place the phone into the module jig. Turn power on by connecting FPS-10 cable, or setting the jig to “auto power on” mode, or by connecting the charger.
Phone boots up normally?
NO
Go to General power troubleshooting
YES
Check the battery connector X2070. Still not ok?
NO
Go to General power troubleshooting

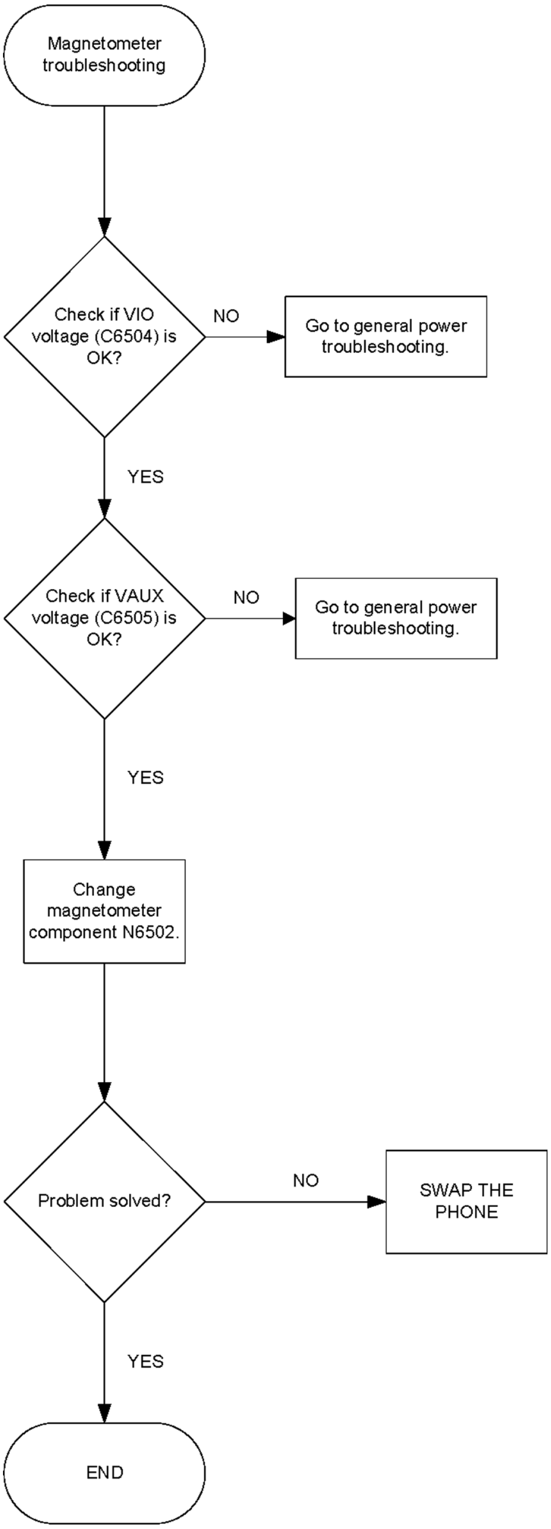
Accelerometer troubleshooting

Troubleshooting flow


Accelerometer troubleshooting
Check VIO voltage (C6502)OK?
No
Go to general power troubleshooting
Yes
Check VAUX voltage (C6503)OK?
No
Go to general power troubleshooting
Yes
Change accelerometer component N6501
Problem solved?
No
SWAP THE PHONE
Yes
END

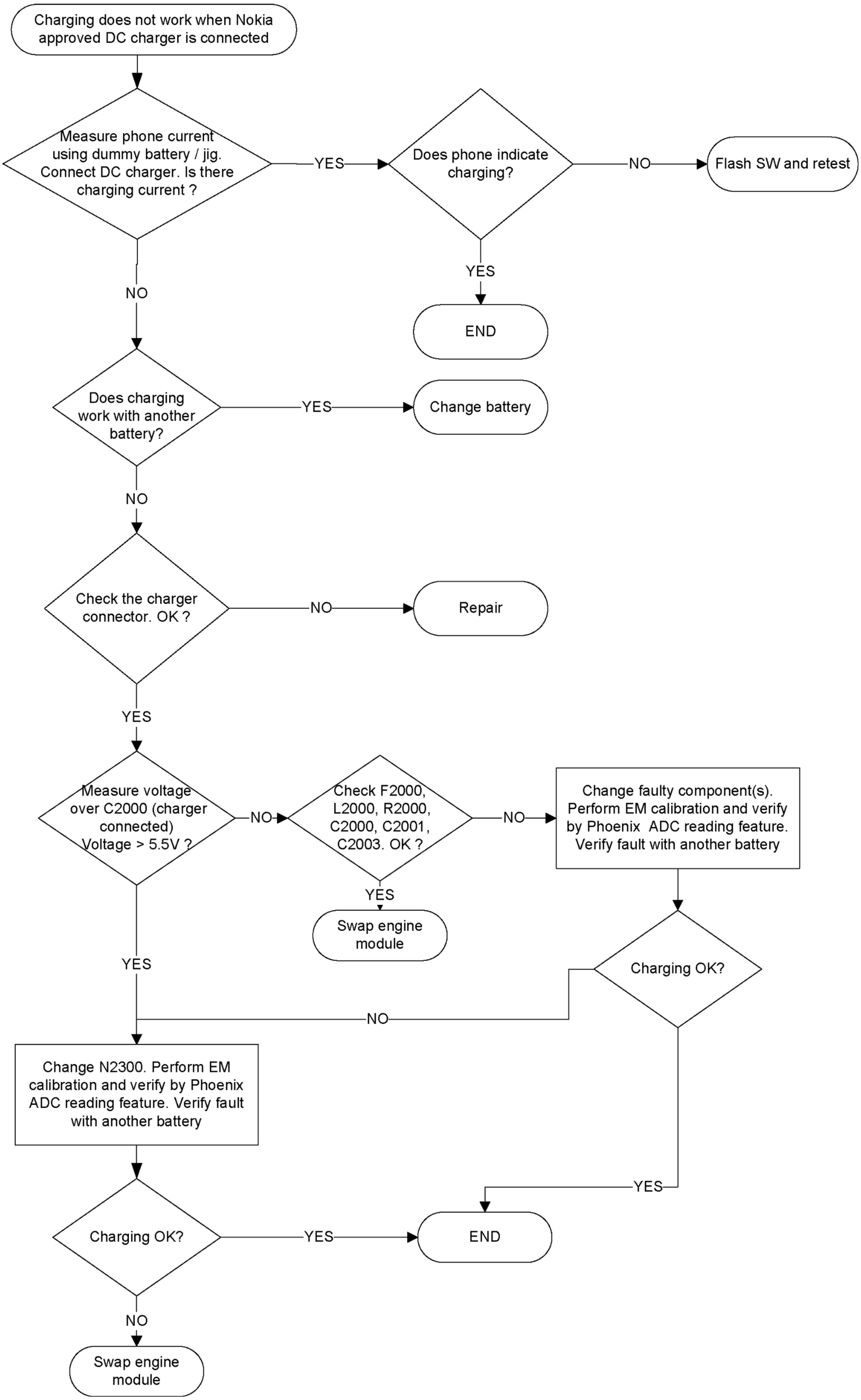
Magnetometer troubleshooting

Troubleshooting flow


Magnetometer troubleshooting
Check if VIO voltage (C6504) is OK?
NO
Go to general power troubleshooting.
YES
Check if VAUX voltage (C6505) is OK?
NO
Go to general power troubleshooting.
YES
Change magnetometer component N6502.
Problem solved?
NO
SWAP THE PHONE
YES
END

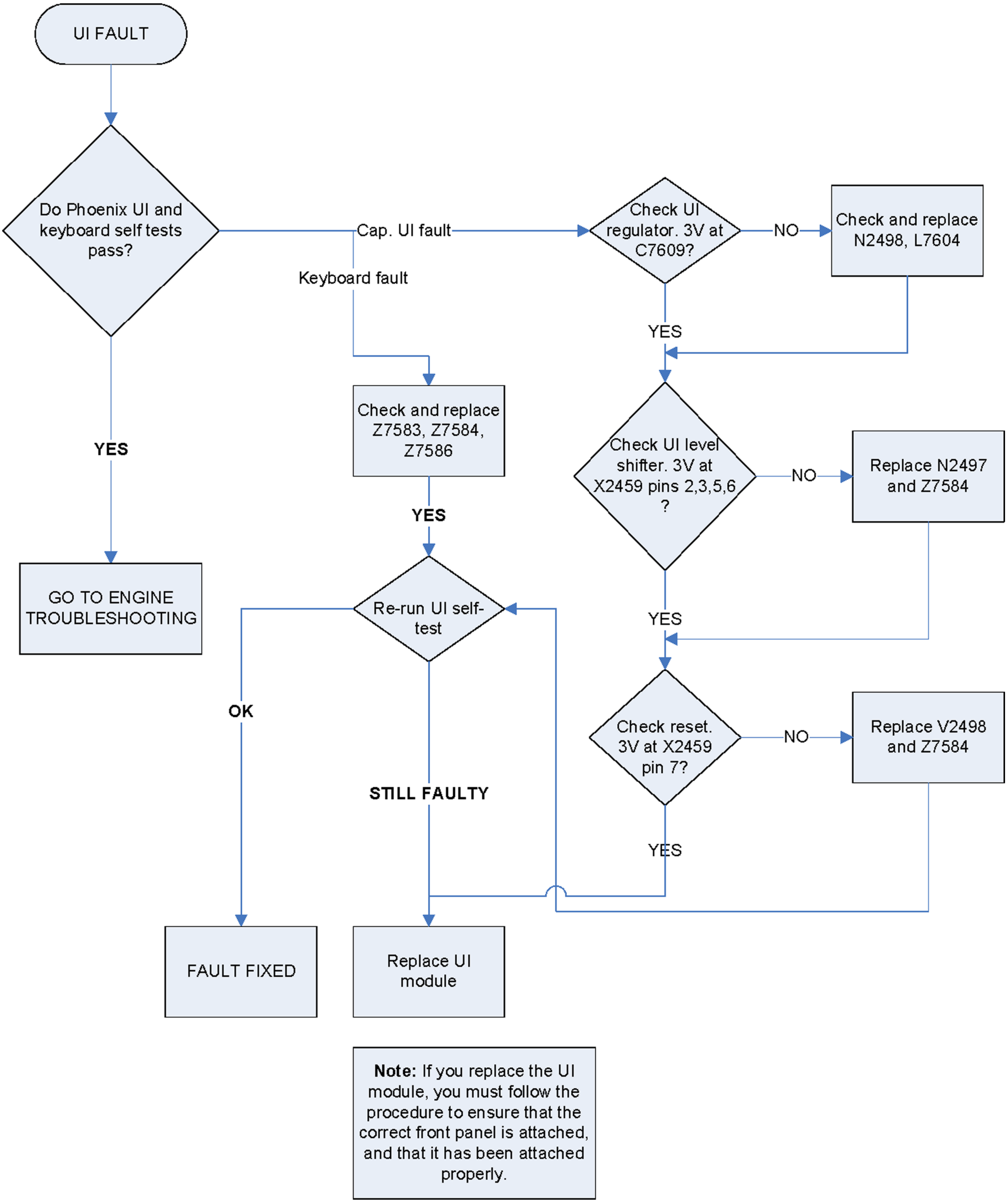
Charging troubleshooting

Troubleshooting flow


Charging does not work when Nokia approved DC charger is connected
Measure phone current using dummy battery / jig. Connect DC charger. Is there charging current ?
YES
Does phone indicate charging?
NO
Flash SW and retest
YES
END
NO
Does charging work with another battery?
YES
Change battery
NO
Check the charger connector. OK ?
NO
Repair
YES
Measure voltage over C2000 (charger connected) Voltage > 5.5V ?
NO
Check F2000, L2000, R2000, C2000, C2001, C2003. OK ?
NO
Change faulty component(s). Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery
YES
Swap engine module
Charging OK?
YES
NO
Change N2300. Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery
YES
Charging OK?
YES
END
NO
Swap engine module

User interface troubleshooting

Troubleshooting flow


UI FAULT
Do Phoenix UI and keyboard self tests pass?
Cap. UI fault
Keyboard fault
Check UI regulator. 3V at C7609?
NO
Check and replace N2498, L7604
YES
Check and replace Z7583, Z7584, Z7586
YES
Check UI level shifter. 3V at X2459 pins 2,3,5,6 ?
NO
Replace N2497 and Z7584
YES
GO TO ENGINE TROUBLESHOOTING
Re-run UI self-test
YES
OK
Check reset. 3V at X2459 pin 7?
NO
Replace V2498 and Z7584
STILL FAULTY
YES
FAULT FIXED
Replace UI module

Note: If you replace the UI module, you must follow the procedure to ensure that the correct front panel is attached, and that it has been attached properly.

Display Troubleshooting

Display Troubleshooting

Display blank

There is no image on the display. Display looks the same as if the phone is off even when the phone is on.

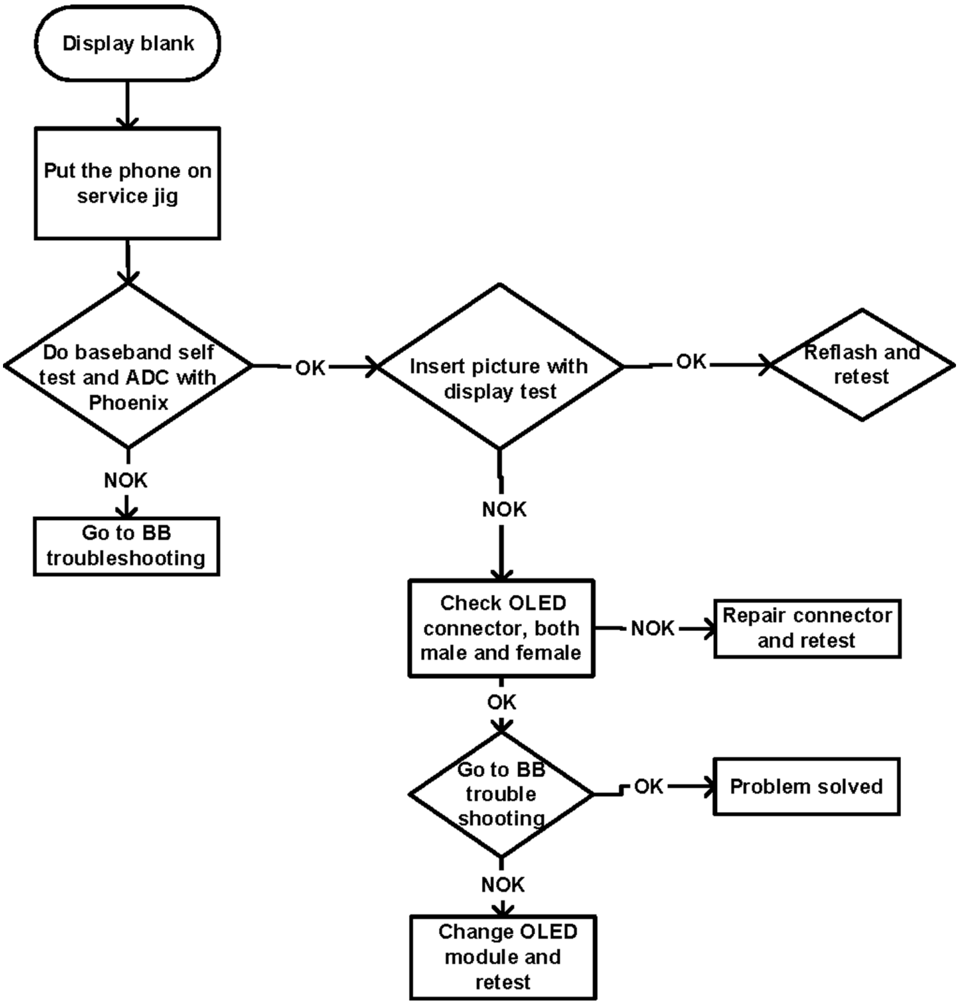
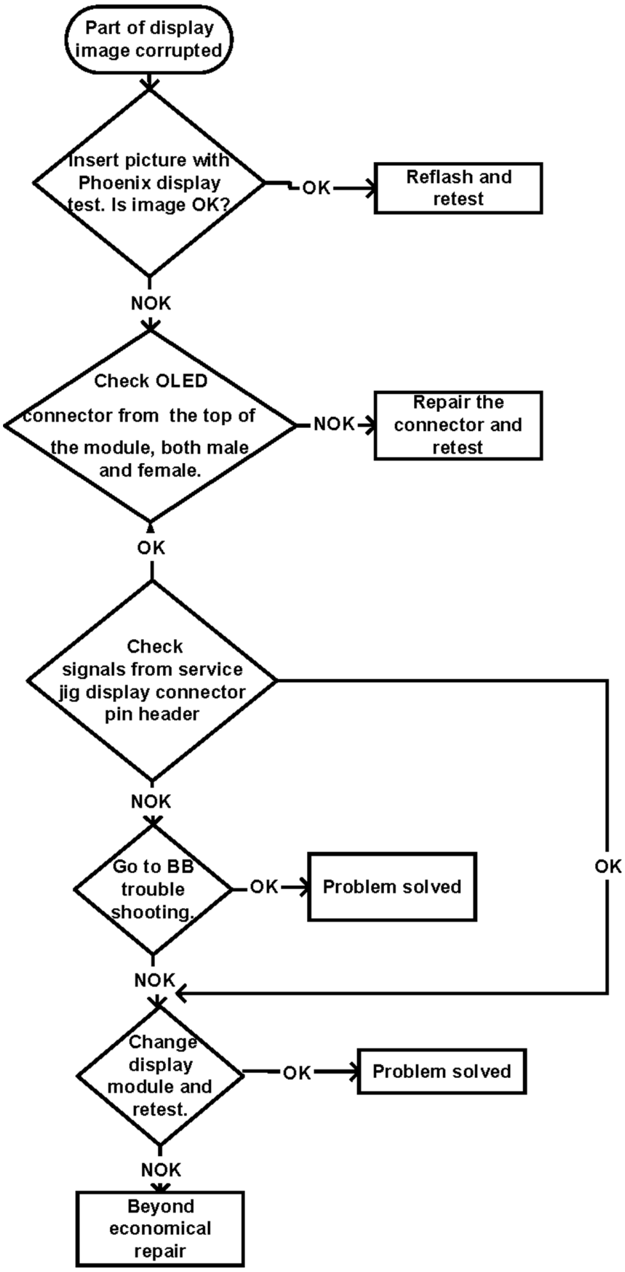

Display blank
Put the phone on service jig
Do baseband self test and ADC with Phoenix
OK
NOK
Go to BB troubleshooting
Insert picture with display test
OK
Reflash and retest
NOK
Check OLED connector, both male and female
NOK
Repair connector and retest
OK
Go to BB trouble shooting
OK
Problem solved
NOK
Change OLED module and retest

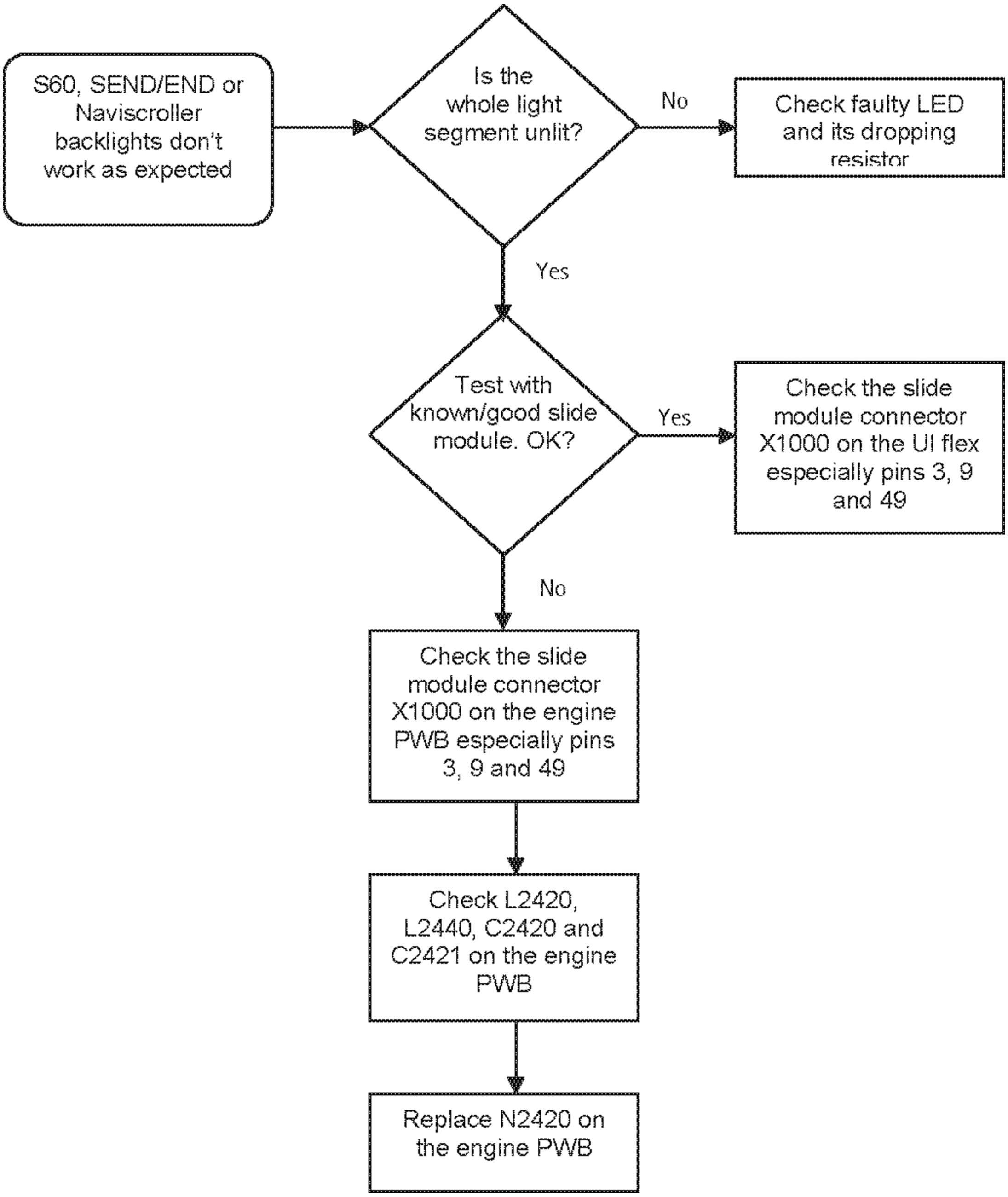
Image on display not correct

Image on the display can be corrupted or part of the image can be missing. If part of image is missing change the UI module. If the image is otherwise corrupted, follow the path below.

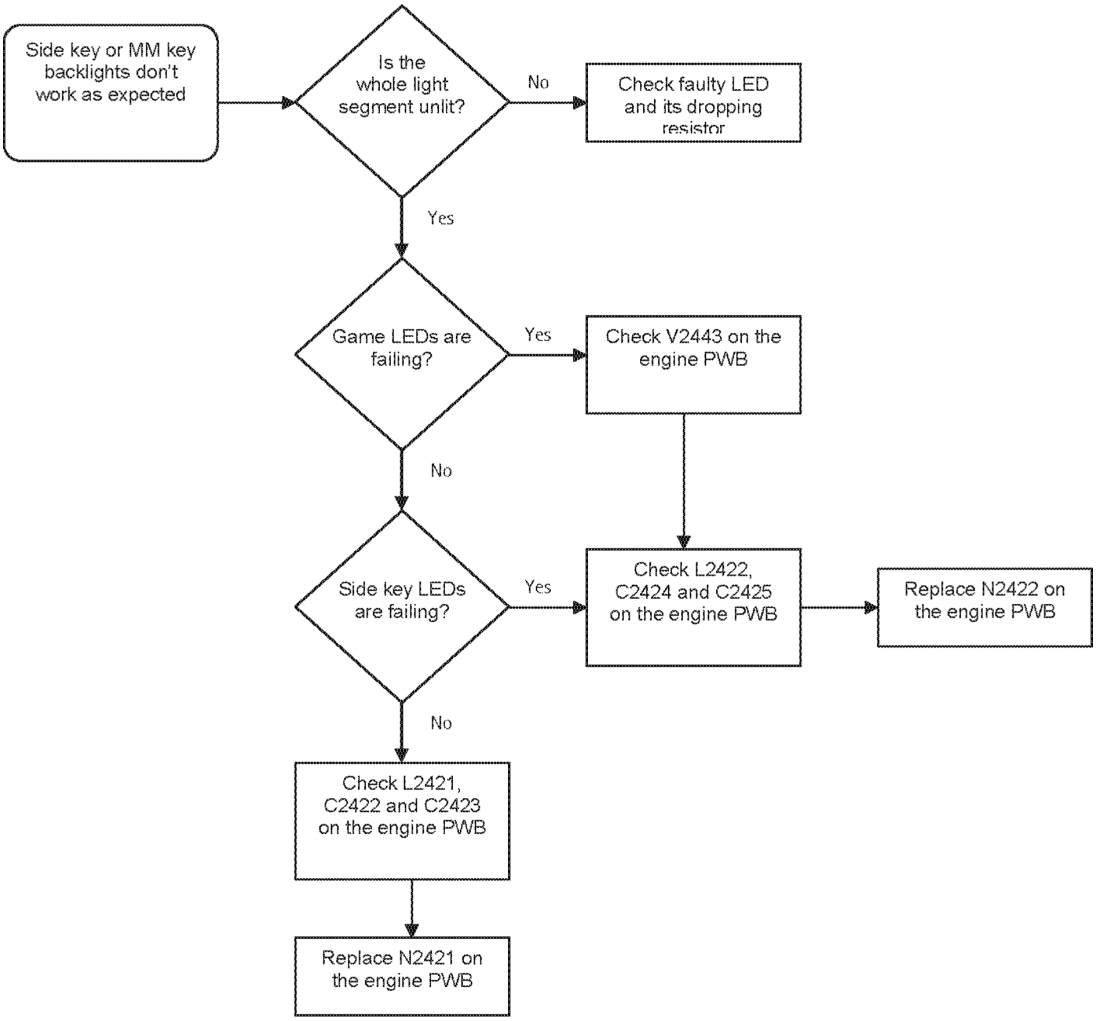

Part of display image corrupted
Insert picture with Phoenix display test. Is image OK?
OK
Reflash and retest
NOK
Check OLED connector from the top of the module, both male and female.
NOK
Repair the connector and retest
OK
Check signals from service jig display connector pin header
OK
NOK
Go to BB trouble shooting.
OK
Problem solved
NOK
Change display module and retest.
OK
Problem solved
NOK
Beyond economical repair

Illumination troubleshooting

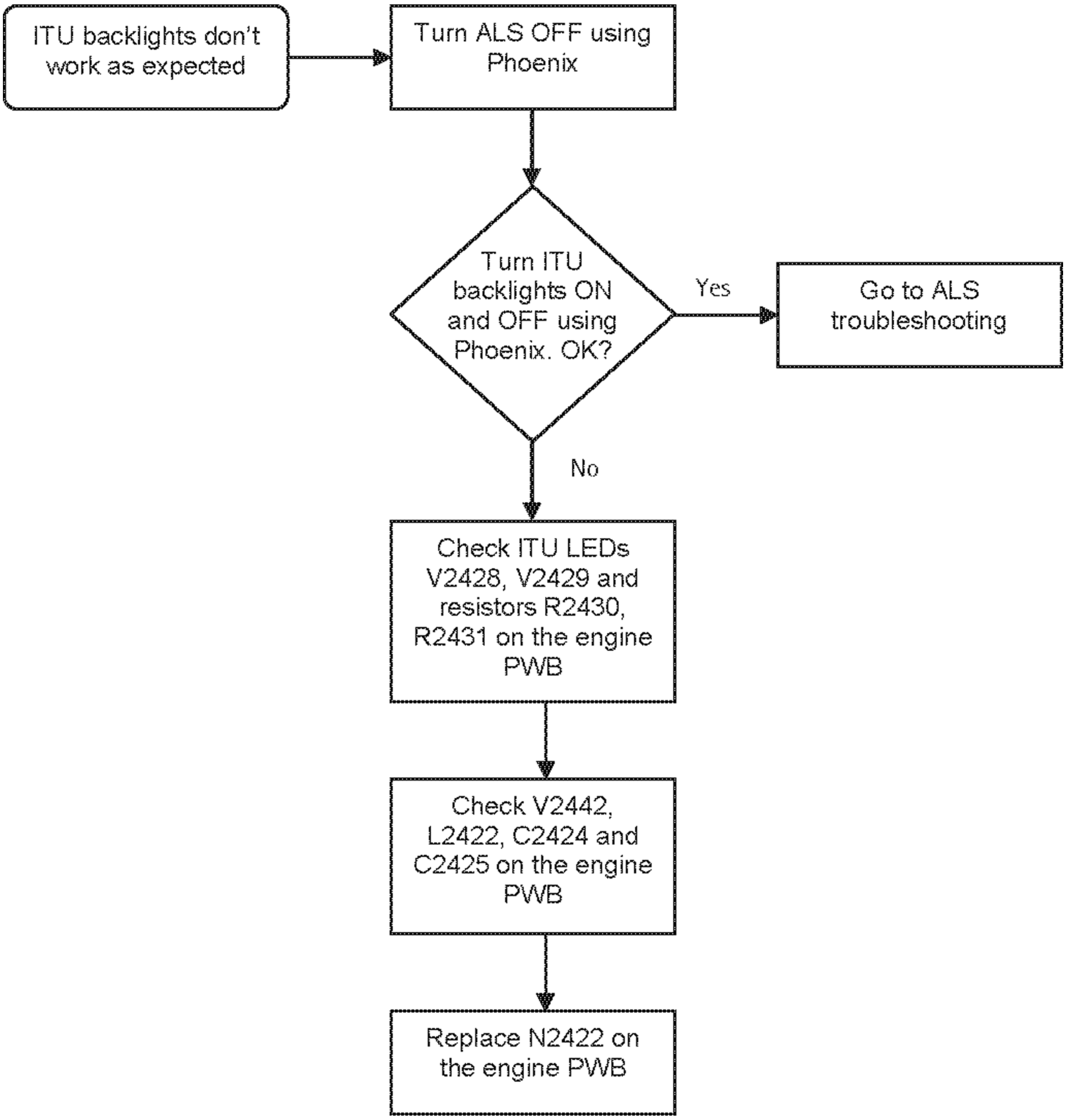
Troubleshooting flow


S60, SEND/END or Naviscroller backlights don't work as expected
Is the whole light segment unlit?
No
Check faulty LED and its dropping resistor
Yes
Test with known/good slide module. OK?
Yes
Check the slide module connector X1000 on the UI flex especially pins 3, 9 and 49
No
Check the slide module connector X1000 on the engine PWB especially pins 3, 9 and 49
Check L2420, L2440, C2420 and C2421 on the engine PWB
Replace N2420 on the engine PWB

Troubleshooting flow

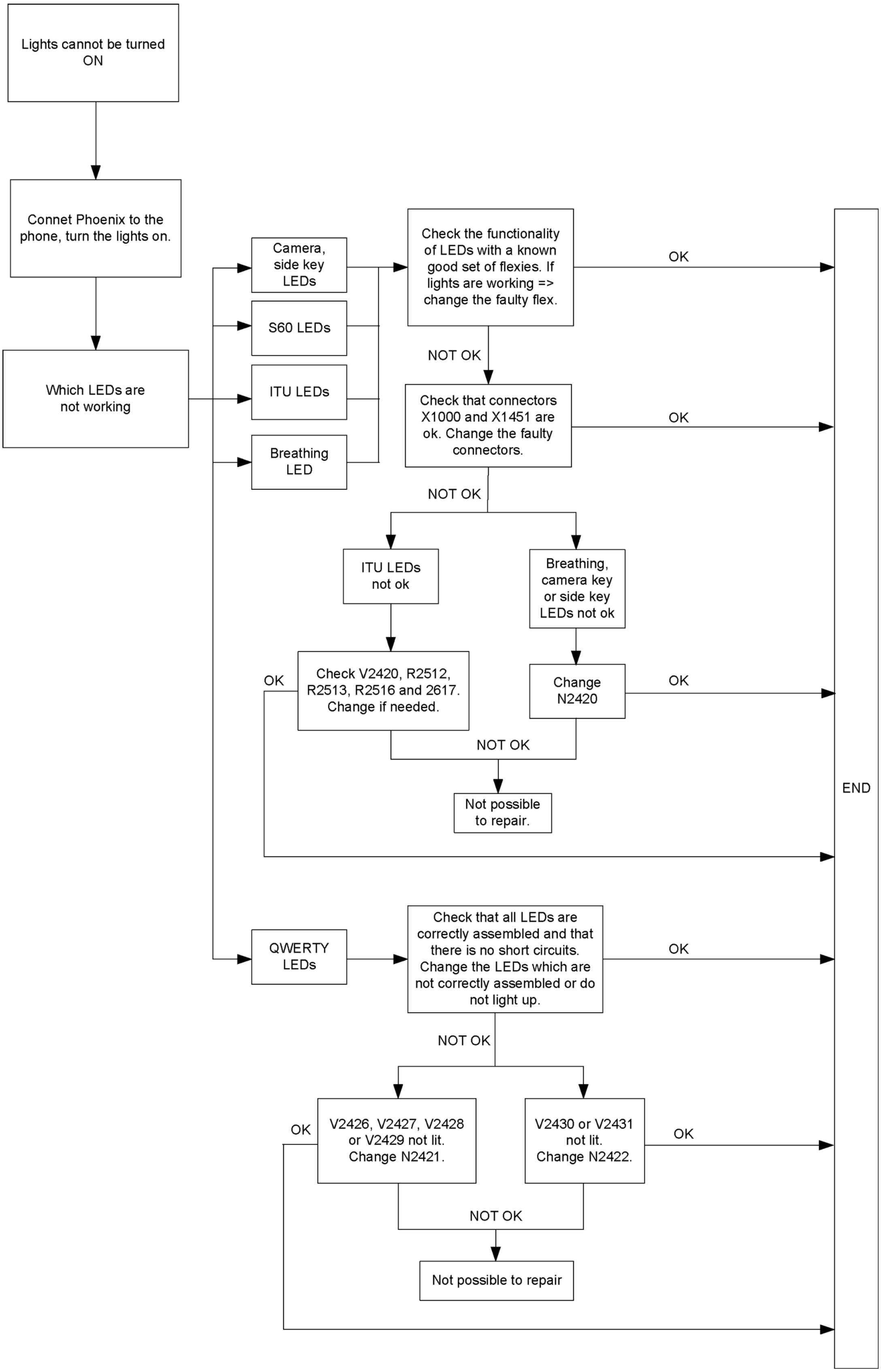

Side key or MM key backlights don't work as expected
Is the whole light segment unlit?
No
Check faulty LED and its dropping resistor
Yes
Game LEDs are failing?
Yes
Check V2443 on the engine PWB
No
Side key LEDs are failing?
Yes
Check L2422, C2424 and C2425 on the engine PWB
Replace N2422 on the engine PWB
No
Check L2421, C2422 and C2423 on the engine PWB
Replace N2421 on the engine PWB

Troubleshooting flow


ITU backlights don't work as expected
Turn ALS OFF using Phoenix
Turn ITU backlights ON and OFF using Phoenix. OK?
Yes
Go to ALS troubleshooting
No
Check ITU LEDs V2428, V2429 and resistors R2430, R2431 on the engine PWB
Check V2442, L2422, C2424 and C2425 on the engine PWB
Replace N2422 on the engine PWB

LED driver troubleshooting

Troubleshooting flow


Lights cannot be turned ON
Connet Phoenix to the phone, turn the lights on.
Which LEDs are not working
Camera, side key LEDs
S60 LEDs
ITU LEDs
Breathing LED
QWERTY LEDs
Check the functionality of LEDs with a known good set of flexies. If lights are working => change the faulty flex.
OK
NOT OK
Check that connectors X1000 and X1451 are ok. Change the faulty connectors.
OK
NOT OK
ITU LEDs not ok
Breathing, camera key or side key LEDs not ok
Check V2420, R2512, R2513, R2516 and 2617. Change if needed.
OK
Change N2420
OK
NOT OK
Not possible to repair.
END
Check that all LEDs are correctly assembled and that there is no short circuits. Change the LEDs which are not correctly assembled or do not light up.
OK
NOT OK
V2426, V2427, V2428 or V2429 not lit. Change N2421.
OK
V2430 or V2431 not lit. Change N2422.
OK
NOT OK
Not possible to repair

Audio Troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2 kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Outout voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	HS_MIC & GND	HS_EAR_L & GND	-8.6	1000	367	1.2	NA
		HS_EAR_R & GND					

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Outout voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	HS_MIC & GND	EarP & GND EarN & GND	-10	1000	310	1.2	NA
External Mic to Internal handsfree	HS_MIC & GND	J2103 & J2104 J2101 & J2102	-6	1000			
Digital Mic to External Earpiece	Acoustical input, 1KHz sine wave	HS_EAR_L & GND	NA	94 dB SPL	100		NA

Measurement data

Earpiece signal

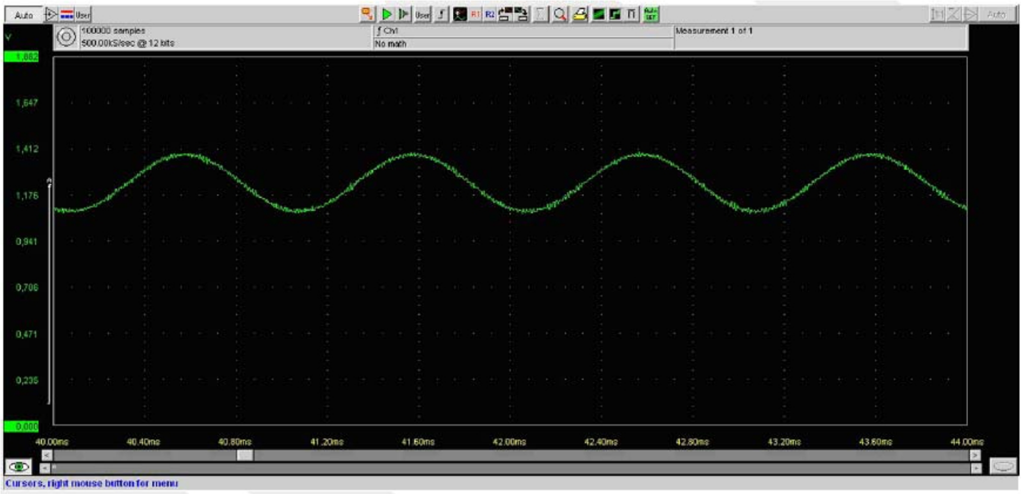

100000 samples
500.00kS/sec @ 12 bits
Ch1
No math
Measurement 1 of 1
Cursers, right mouse button for menu
Auto
User
V
1,882
1,647
1,412
1,176
0,941
0,706
0,471
0,235
0,000
40.00ms
40.40ms
40.80ms
41.20ms
41.60ms
42.00ms
42.40ms
42.80ms
43.20ms
43.60ms
44.00ms

Figure 14 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected

Integrated handsfree signal

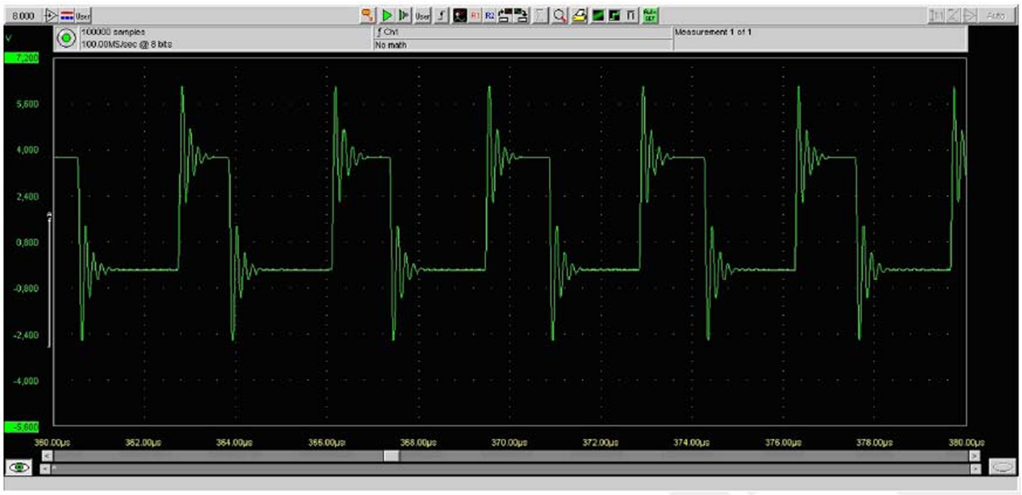


Figure 15 Single-ended output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected (measured at speaker pads), no filter is used

External output from AV

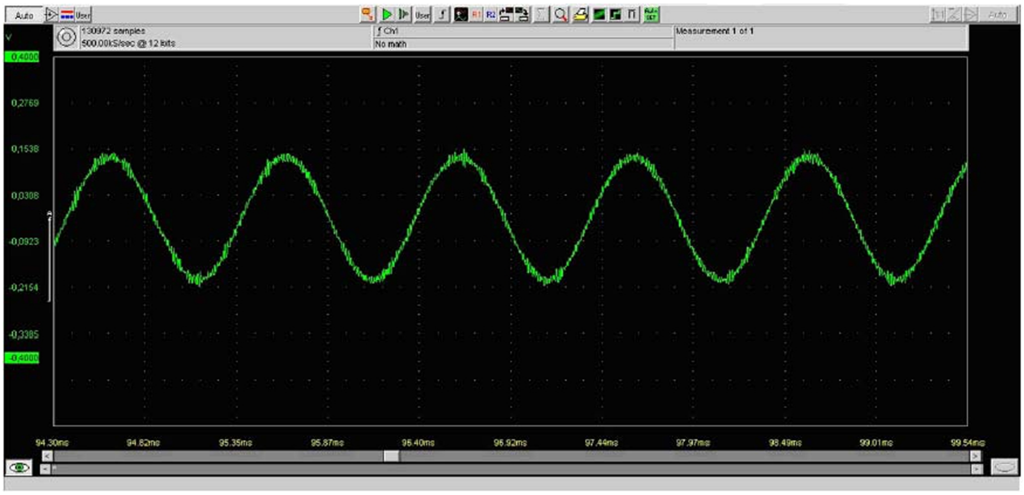


Figure 16 Single-ended output waveform of the Ext_in_Ext_out loop

External output from AV (acoustic input)

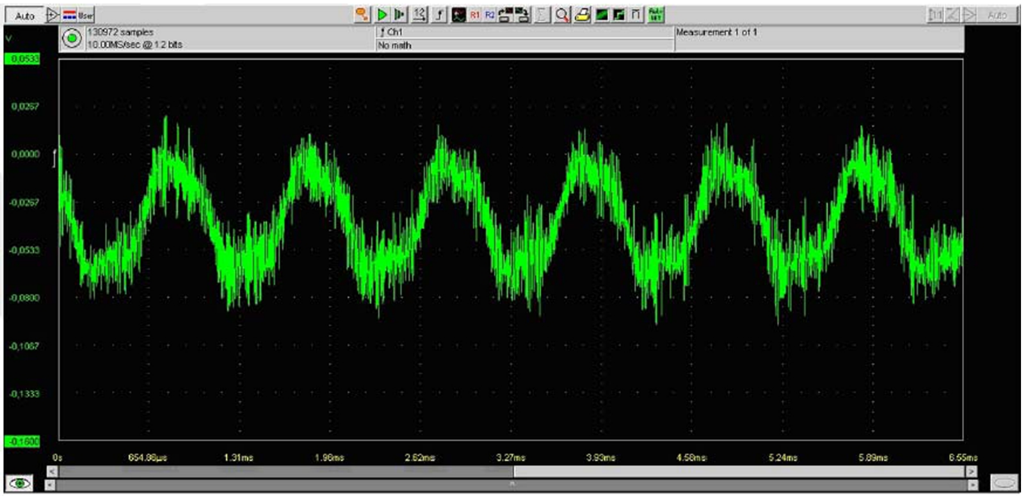
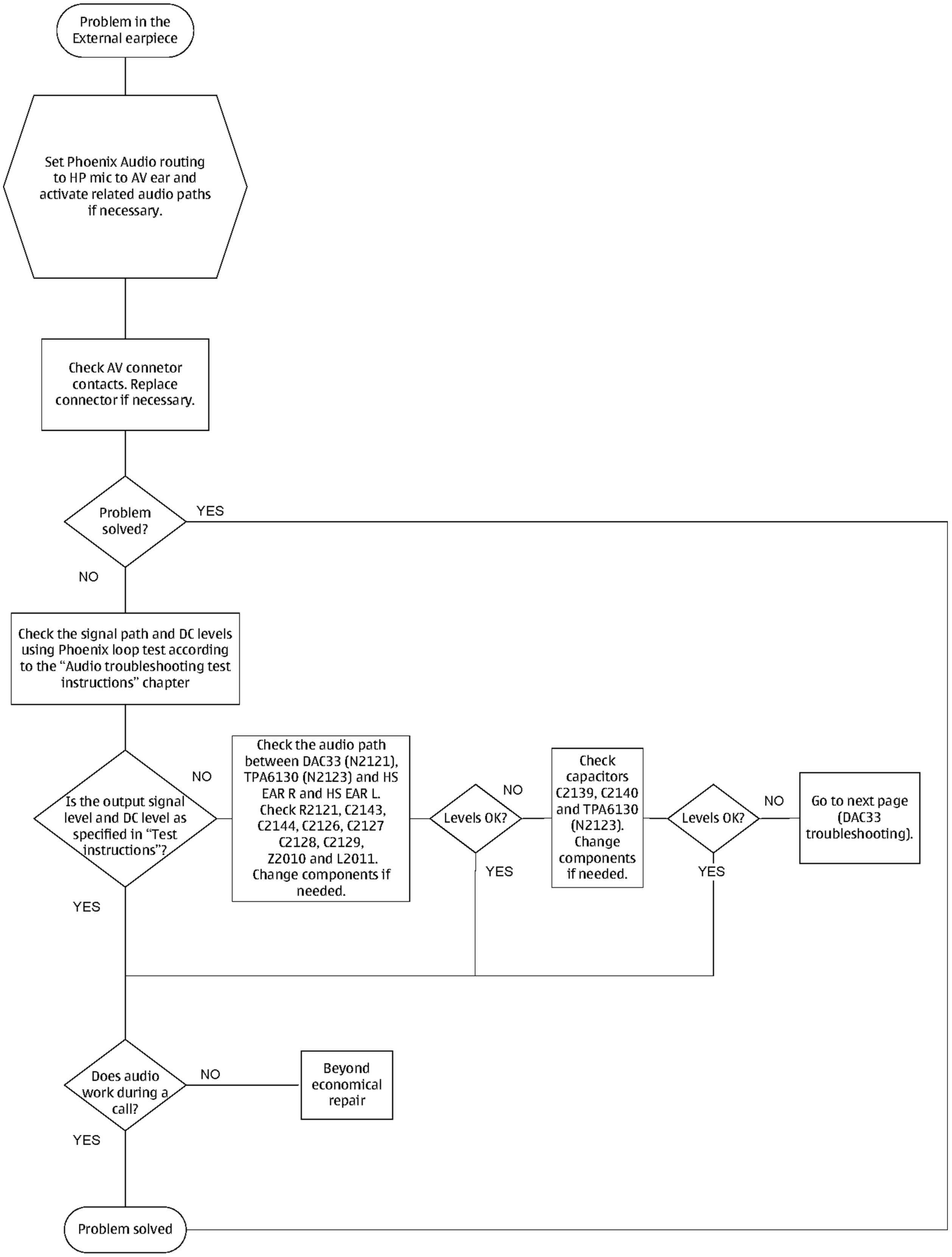


Figure 17 Single-ended output waveform of the Digital_stereo_microphone_in_Ext_out loop

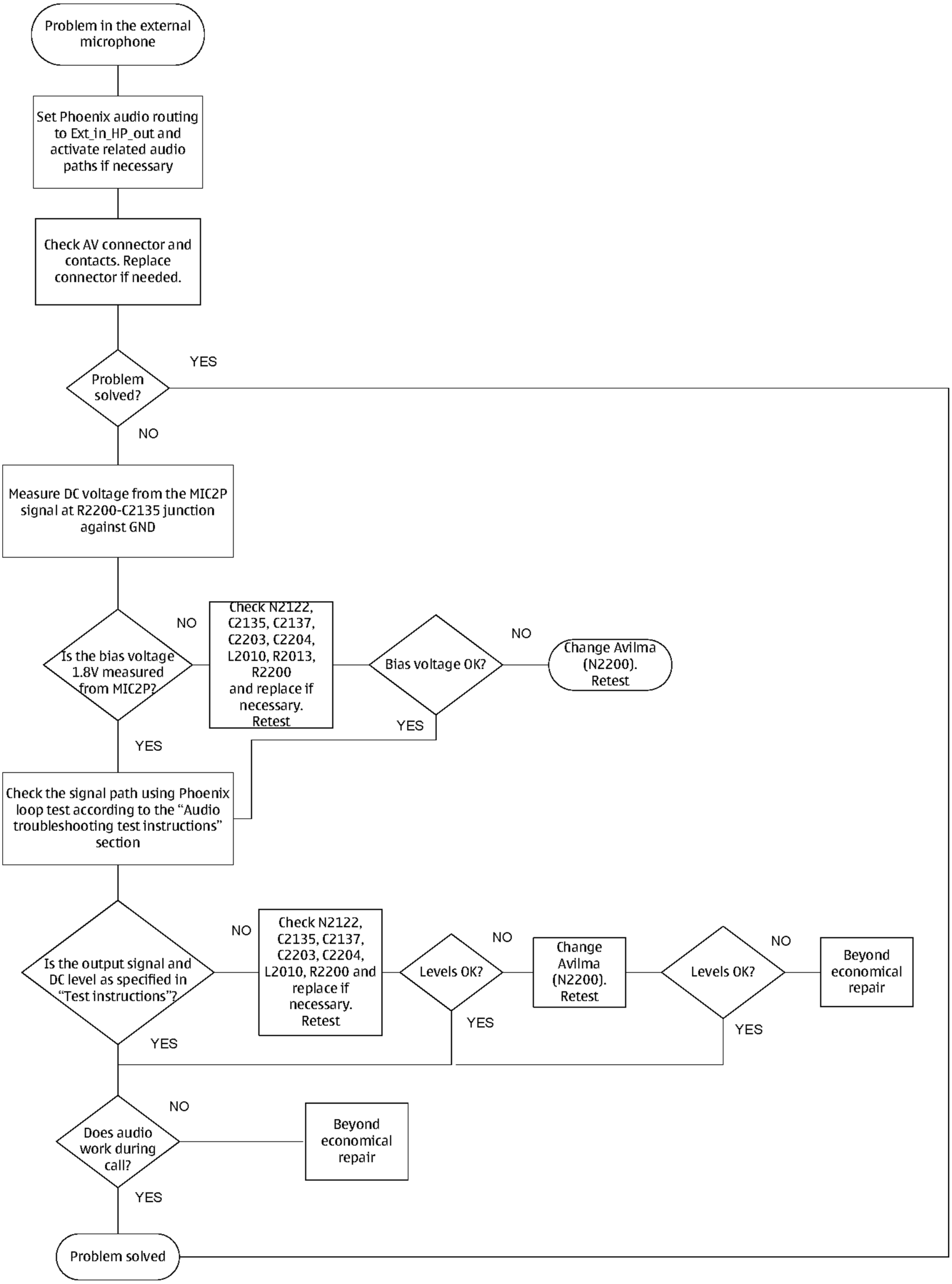
External earpiece troubleshooting

Troubleshooting flow


Problem in the External earpiece
Set Phoenix Audio routing to HP mic to AV ear and activate related audio paths if necessary.
Check AV connetor contacts. Replace connector if necessary.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Audio troubleshooting test instructions" chapter
Is the output signal level and DC level as specified in "Test instructions"?
NO
Check the audio path between DAC33 (N2121), TPA6130 (N2123) and HS EAR R and HS EAR L. Check R2121, C2143, C2144, C2126, C2127 C2128, C2129, Z2010 and L2011. Change components if needed.
Levels OK?
NO
YES
Check capacitors C2139, C2140 and TPA6130 (N2123). Change components if needed.
Levels OK?
NO
YES
Go to next page (DAC33 troubleshooting).
YES
Does audio work during a call?
NO
Beyond economical repair
YES
Problem solved

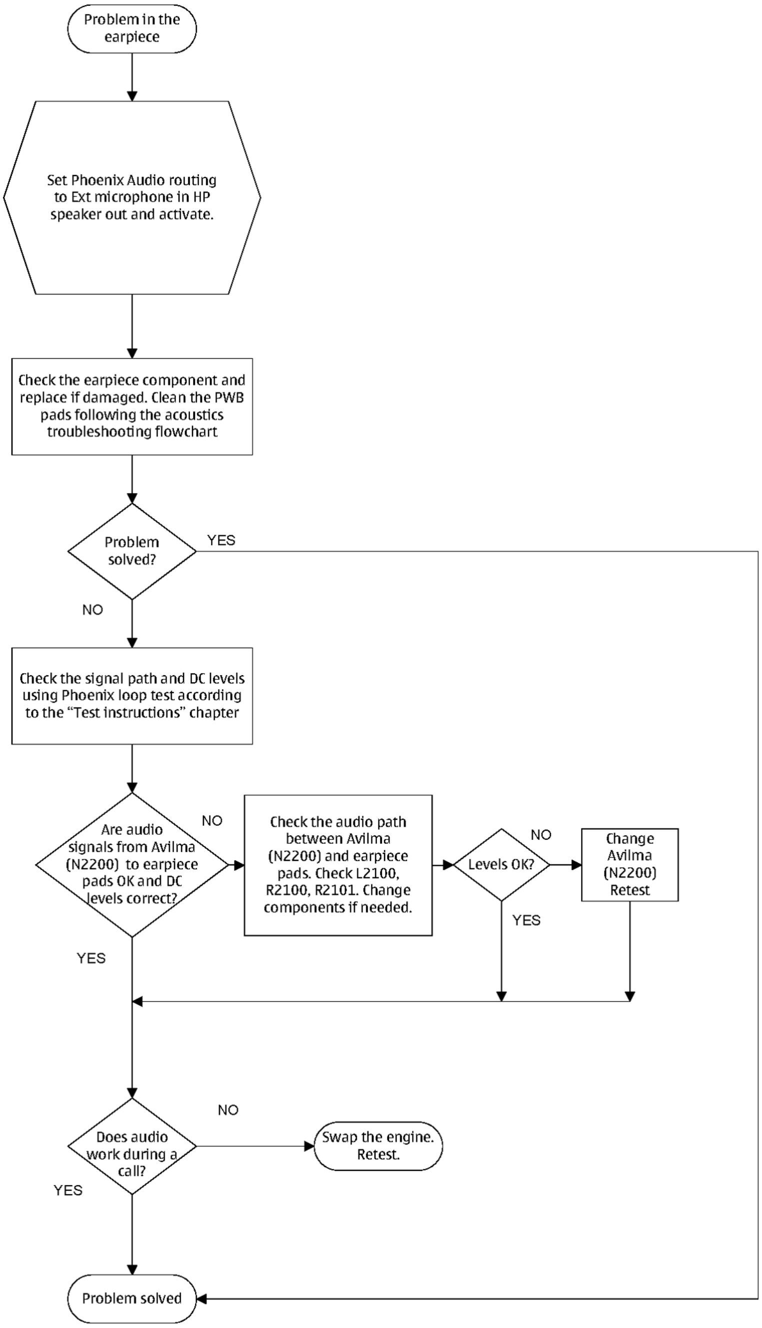
External microphone troubleshooting

Troubleshooting flow


Problem in the external microphone
Set Phoenix audio routing to Ext_in_HP_out and activate related audio paths if necessary
Check AV connector and contacts. Replace connector if needed.
Problem solved?
YES
NO
Measure DC voltage from the MIC2P signal at R2200-C2135 junction against GND
Is the bias voltage 1.8V measured from MIC2P?
NO
Check N2122, C2135, C2137, C2203, C2204, L2010, R2013, R2200 and replace if necessary. Retest
Bias voltage OK?
NO
Change Avilma (N2200). Retest
YES
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Is the output signal and DC level as specified in "Test instructions"?
NO
Check N2122, C2135, C2137, C2203, C2204, L2010, R2200 and replace if necessary. Retest
Levels OK?
NO
Change Avilma (N2200). Retest
Levels OK?
NO
Beyond economical repair
YES
YES
YES
Does audio work during call?
NO
Beyond economical repair
YES
Problem solved

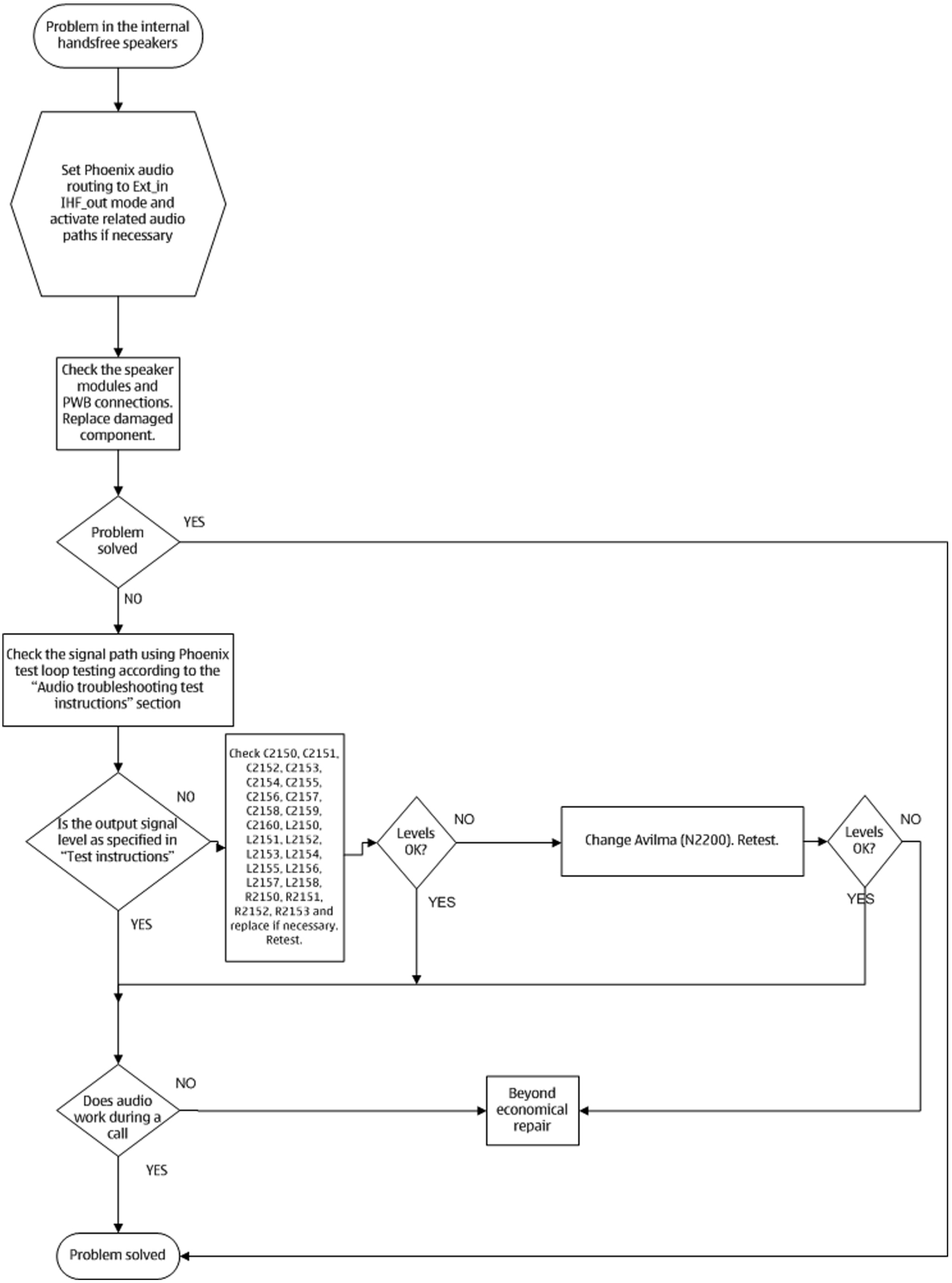
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Set Phoenix Audio routing to Ext microphone in HP speaker out and activate.
Check the earpiece component and replace if damaged. Clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Are audio signals from Avilma (N2200) to earpiece pads OK and DC levels correct?
NO
Check the audio path between Avilma (N2200) and earpiece pads. Check L2100, R2100, R2101. Change components if needed.
Levels OK?
NO
Change Avilma (N2200) Retest
YES
YES
Does audio work during a call?
NO
Swap the engine. Retest.
YES
Problem solved

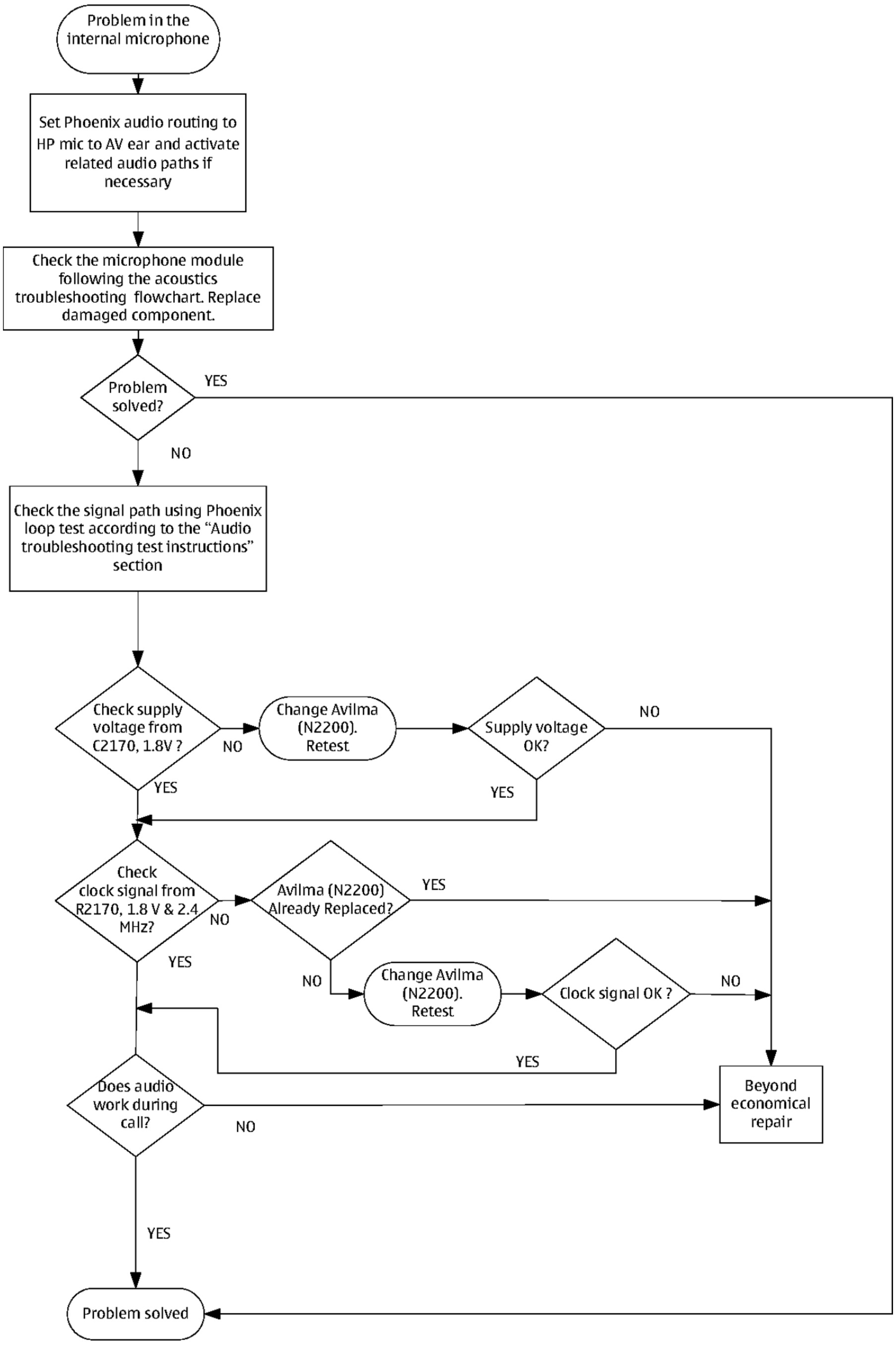
Internal handsfree speaker troubleshooting

Troubleshooting flow


Problem in the internal handsfree speakers
Set Phoenix audio routing to Ext_in IHF_out mode and activate related audio paths if necessary
Check the speaker modules and PWB connections. Replace damaged component.
Problem solved
YES
NO
Check the signal path using Phoenix test loop testing according to the "Audio troubleshooting test instructions" section
Is the output signal level as specified in "Test instructions"
NO
YES
Check C2150, C2151, C2152, C2153, C2154, C2155, C2156, C2157, C2158, C2159, C2160, L2150, L2151, L2152, L2153, L2154, L2155, L2156, L2157, L2158, R2150, R2151, R2152, R2153 and replace if necessary. Retest.
Levels OK?
NO
YES
Change Avilma (N2200). Retest.
Levels OK?
NO
YES
Does audio work during a call
NO
YES
Beyond economical repair
Problem solved

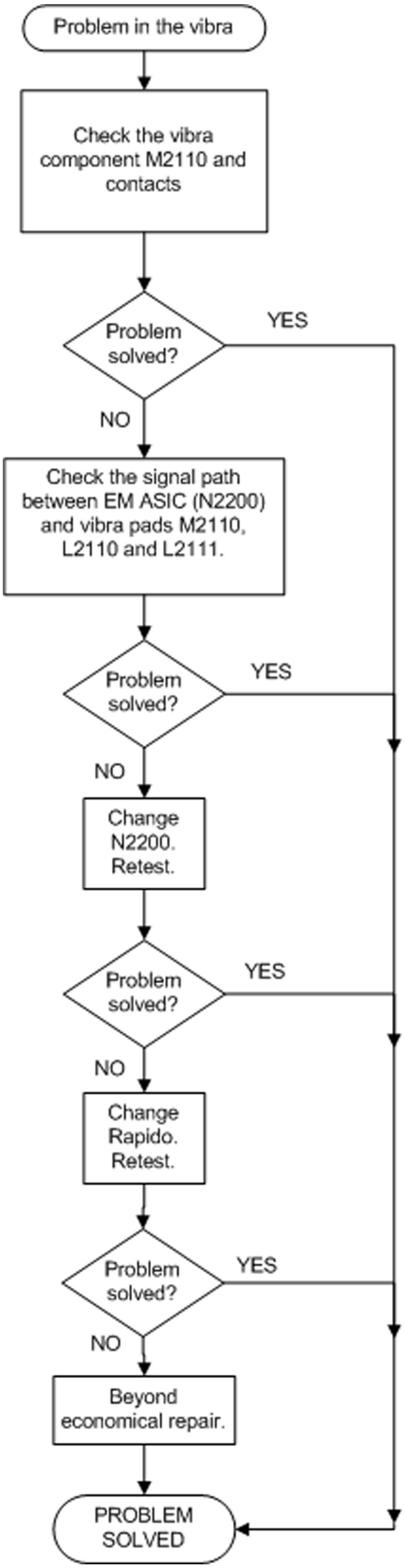
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone
Set Phoenix audio routing to HP mic to AV ear and activate related audio paths if necessary
Check the microphone module following the acoustics troubleshooting flowchart. Replace damaged component.
Problem solved?
YES
NO
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Check supply voltage from C2170, 1.8V ?
NO
Change Avilma (N2200). Retest
Supply voltage OK?
NO
YES
YES
Check clock signal from R2170, 1.8 V & 2.4 MHz?
NO
Avilma (N2200) Already Replaced?
YES
YES
NO
Change Avilma (N2200). Retest
Clock signal OK ?
NO
YES
Does audio work during call?
NO
Beyond economical repair
YES
Problem solved

Vibra troubleshooting

Troubleshooting flow


Problem in the vibra
Check the vibra component M2110 and contacts
Problem solved?
YES
NO
Check the signal path between EM ASIC (N2200) and vibra pads M2110, L2110 and L2111.
Problem solved?
YES
NO
Change N2200. Retest.
Problem solved?
YES
NO
Change Rapido. Retest.
Problem solved?
YES
NO
Beyond economical repair.
PROBLEM SOLVED

ALS Technical Description and Troubleshooting

Ambient Light Sensor

Ambient Light Sensor

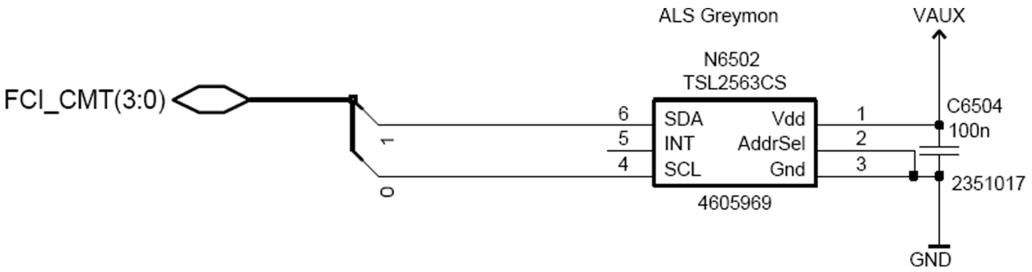


Figure 18 Ambient Light Sensor

Ambient Light Sensor consists of the following components:

- Light guide
- Ambient Light Sensor (ALS)

  ALS is a digital I2C interface component, having two channels with different spectral sensitivities. When combined, the component responds to illuminance similar as human eye.
- Vdd Filtering capacitor C1103

Ambient Light Sensor information is used to control keypad and display brightness of the phone.

Keyboard backlight is turned OFF, when it's not needed. Display brightness is dimmed, when environment lighting is dark.

Ambient Light Sensor is calibrated in production and can be re-tuned in service points though not recommended unless calibration coefficient are lost for some reason

ALS troubleshooting

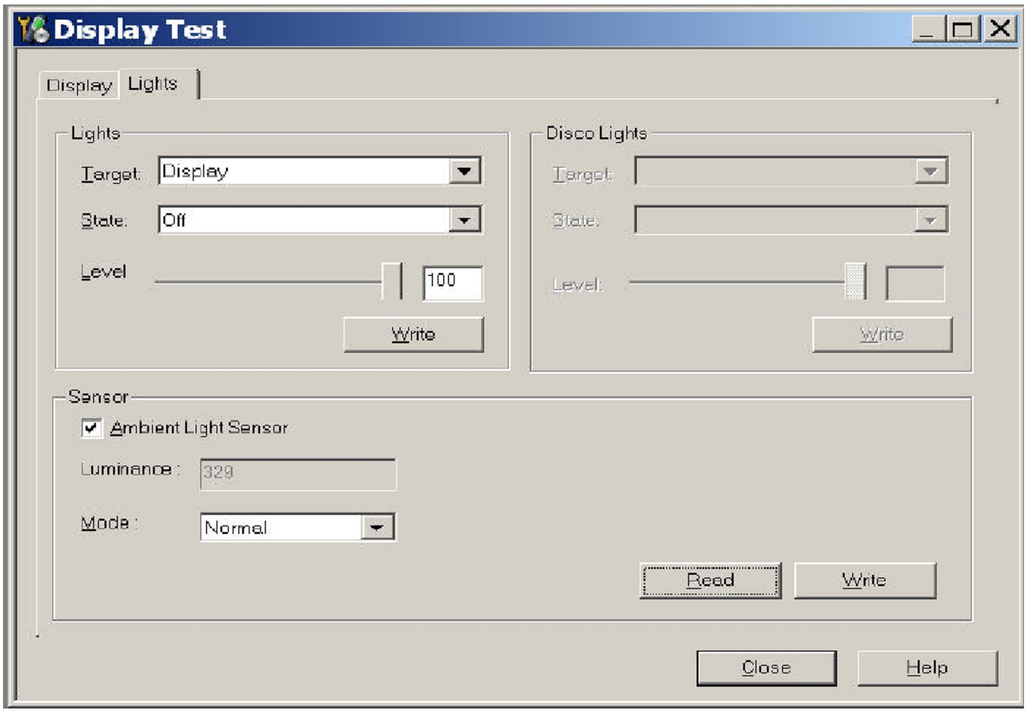
Context

Functionality check:

Steps

1. Connect phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.
2. Start Phoenix
3. Choose **File -> Scan product**
4. Choose **Testing -> Display Test**
5. Open the **Lights** tab, check Ambient Light Sensor check box, click **Read**, cover the sensor and click **Read** again. When covered, Luminance reading should be less than after clicking **Read** without covering the sensor.

6. If component doesn’t give any reading or reading doesn’t change when sensor is/is not covered, replace the part.


Display Test
Display
Lights
Lights
Disco Lights
Target:
State:
Level:
Write
Write
Sensor
Read
Write
Close
Help

Target: Display
State: Off
Level: 100
☑ Ambient Light Sensor
Luminance : 329
Mode : Normal

Note: After replacing the ALS. If calibration values of the new sensor are lost or for some other reason, ALS re-tuning is required (see instructions later in this document).

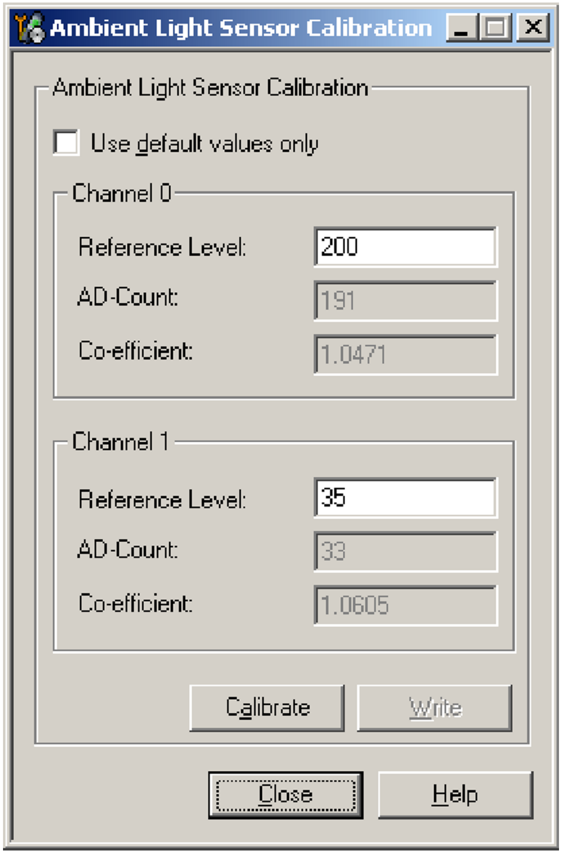
When doing the ALS calibration procedure, it is required to have a reference phone, which includes calibrated ALS. ALS re-tuning instructions show why the reference phone is needed.

Re-tuning ALS

Steps

1. Connect reference phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.
2. Start Phoenix.
3. Choose **File→Scan Product.**

4. Choose **Tuning -> Ambient Light Sensor Calibration**. You should see the following window:



Ambient Light Sensor Calibration
Ambient Light Sensor Calibration
Channel 0
Channel 1
Calibrate
Write
Close
Help

☐ Use default values only

Channel 0

Reference Level: 200

AD-Count: 191

Co-efficient: 1.0471

Channel 1

Reference Level: 35

AD-Count: 33

Co-efficient: 1.0605

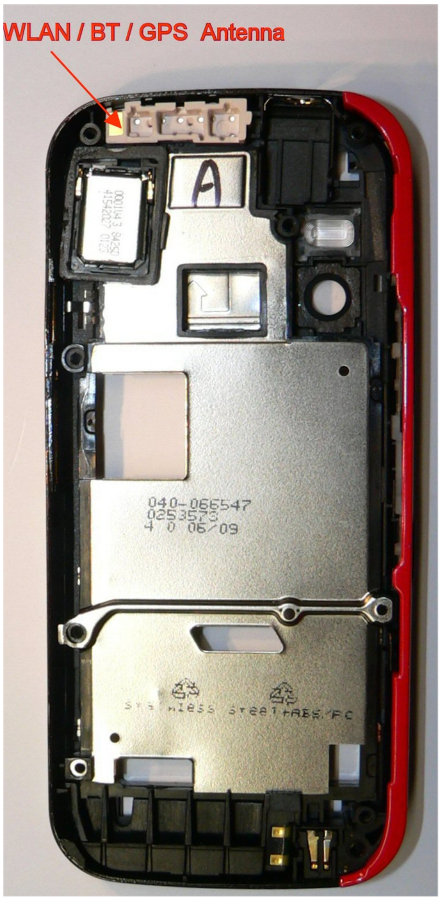
5. Read AD-count values for Channel 0 and Channel 1 by click **Read** button and write them down.
6. Repeat 1-5 for the phone to be calibrated and make sure the phone to be calibrated is located in the same place as reference phone was when luminance reading was taken.
7. Calculate co-efficient from reference phone and phone to be calibrated AD-count values by division: Co-efficient = AD-count(reference phone) / AD-count(phone to be calibrated), write down the calculated co-efficient values.
8. -> Iterate by changing Channel 0 and Channel 1 (reference level) values (remove cross from 'Use default values only'). After writing some value to Channel 0 and Channel 1 (reference value), calibrate button must be pressed. Stop iterating when Co-efficient is equal to Co-efficient calculated in step 7. Note that decimal numbers should be used in the iteration in order to achieve enough precision (e.g. 200.2455)
9. After having same Co-efficient value in "Co-efficient" textbox as the calculated value, make sure that ambient light values (read using **Testing** → **Display Test** → **"Luminance"** textbox) are almost the same in reference phone and calibrated phone. Remember that illuminance readings for reference and calibrated phones must be done in the same ambient light conditions. If illuminance values differs a lot (difference max. +- 10%), repeat whole ALS re-tuning procedure.
10. To end the calibration, click Close.

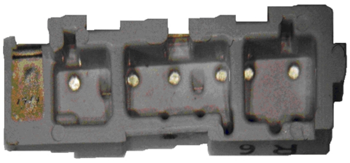
Bluetooth and FM Radio Troubleshooting

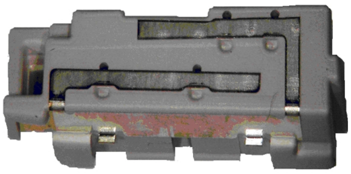
Introduction to Bluetooth/FM radio troubleshooting

Bluetooth/WLAN antenna

The BT RF signal is routed from BTFMRDS2.0 trough the WLAN module to the shared WLAN/BT/GPS antenna in the phone's top side on B cover. The antenna has two resonator for BT/WLAN ISM band and also GPS band and antenna is conducted with a feed (spring) on PWB.







Introduction to Bluetooth/FM radio troubleshooting

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting.

The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface.	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs or SMD components.	Replacement of engine.
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headse.t	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs.	Replacement of engine.

Symptom	Problem	Repair solution
Able to switch on Bluetooth on phone user interface, but unable to detect other Bluetooth devices	Open circuit solder joints or Pogo Pins not making contact with c-cover.	Repair of antenna circuit or replacement BT/WLAN/GPS antenna.
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with Nokia headset inserted.	Open circuit solder joints or detached component in FM antenna circuit.	Repair of FM antenna circuit or replacement AV connector and flex.
Able to perform scans to detect local FM radio stations with functional Nokia headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM audio path between Bluetooth/ FM ASIC and headset.	Repair or replacement of FM audio AV connector and circuits.

Users may experience the following problems resulting in functional phones being returned to the repair centre:

Symptom	Problem	Repair solution
Bluetooth feature does not operate as desired with another Bluetooth device.	Bluetooth Profile implemented in Bluetooth accessory not supported in Nokia phone.	Use Bluetooth accessory with Bluetooth profiles supported by phone.
Poor FM radio reception (unable to detect many radio stations).	Nokia headset not being used.	Use Nokia headset.

Test coverage

The tests listed in the table below should be performed to verify whether the Bluetooth and FM receiver and transmitter are functional. The use of Self Tests are described in section *BT and FM Self Tests in Phoenix*

Test	Test Coverage	Repair solution
Blueooth Self Test: ST_LPRF_IF_TEST	Bluetooth-FM ASIC UART interface (controls Bluetooth and FM receiver and transmitter).	Replacement of engine (or repair of phone BB).
Bluetooth Self Test: ST_BT_WAKEUP_TEST	Bluetooth ASIC interrupt control interface.	Replacement of engine (or repair of phone BB).
Bluetooth Self Test: ST_LPRF_AUDIO_LINES_TEST	Bluetooth ASIC PCM interface.	Replacement of engine (or repair of phone BB).
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device.	Bluetooth antenna circuit.	Repair of Bluetooth antenna matching circuit or replacement B/WLAN/GPS antenna.
FM Radio Self Test: ST_RADIO_TEST	FM Radio I2C interface.	Replacement of engine (or repair of phone BB).

Test	Test Coverage	Repair solution
FM Radio Functional Test: Perform scan for local radio stations and check station list displayed on phone.	FM receiver antenna circuit.	Repair of FM antenna matching circuit or replacement AV connector and flex.
FM Radio Functional Test: Listen to local radio station.	FM receiver audio circuit.	Repair of FM antenna matching circuit or replacement AV connector and flex.

The self tests run from Phoenix software are used for fault diagnosis.

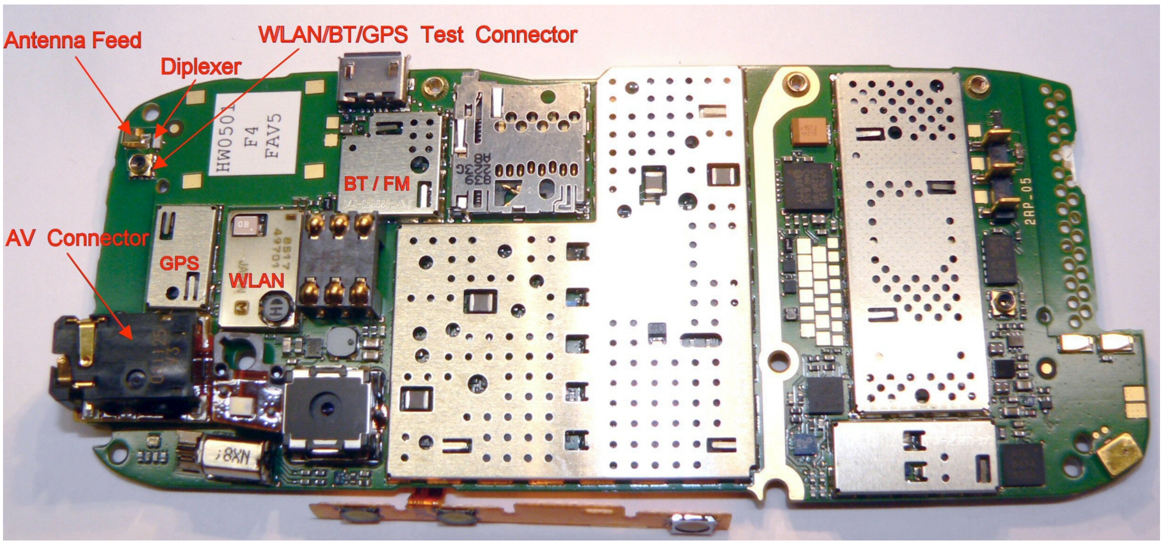
If Phoenix software is not available the functional tests with phone accessories are sufficient to verify the functionality Bluetooth and FM radio receiver and transmitter.

Bluetooth/FM radio component layout and test points

The Bluetooth antenna is product specific (ceramic antenna conducted by feed on PWB). On phones with WLAN and GPS, the Bluetooth RF signal is routed through a WLAN front-end module via diplexer and a shared Bluetooth/WLAN/GPS antenna is used.

The FM RF signal is routed through the FM antenna matching circuit to the phone headset AV connector.

The FM radio audio signal is routed to the headset AV connector through the BB ASIC shared by the phone audio functions



Bluetooth BER test

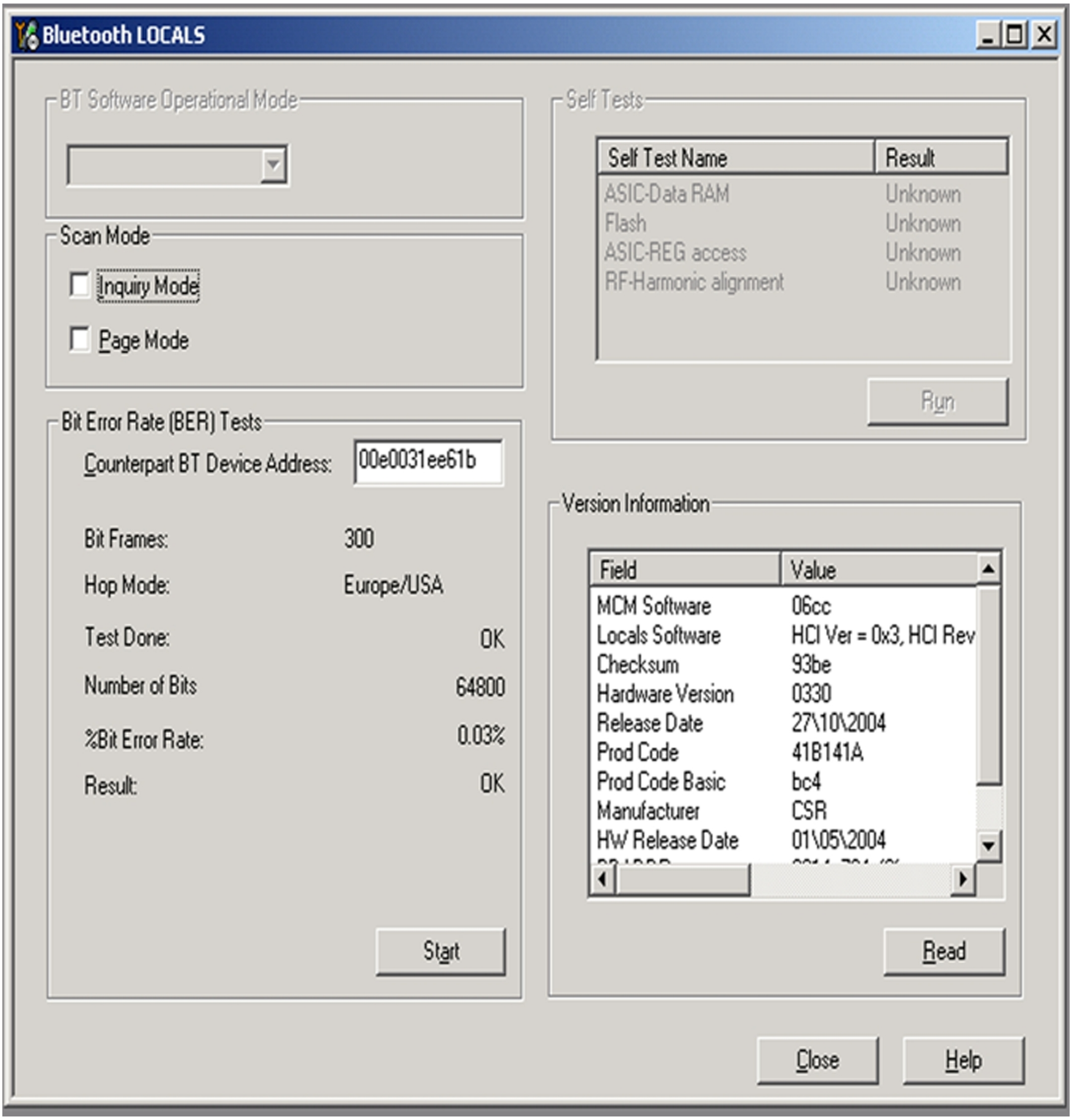
Prerequisites

JBT-9, or SB-6 Bluetooth test box (BT-box) is required to perform a BER test. If a BT-box if not available Bluetooth functionality can be checked by transfering a file to another Bluetooth phone.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product**.

4. Choose **Testing** → **Bluetooth LOCALS** .
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-9, or SB-6 Bluetooth test box.
6. In the Bluetooth *LOCALS* window, write the 12-digit serial number on the *Counterpart BT Device Address* line.
7. Place the BT-box near (within 10 cm) of the phone and click **Start BER Test**.


Bluetooth LOCALS
BT Software Operational Mode
Scan Mode
Bit Error Rate (BER) Tests
Self Tests
Run
Version Information
Start
Read
Close
Help

☐ Inquiry Mode
☐ Page Mode

Counterpart BT Device Address: 00e0031ee61b

Bit Frames:	300
Hop Mode:	Europe/USA
Test Done:	OK
Number of Bits	64800
%Bit Error Rate:	0.03%
Result:	OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

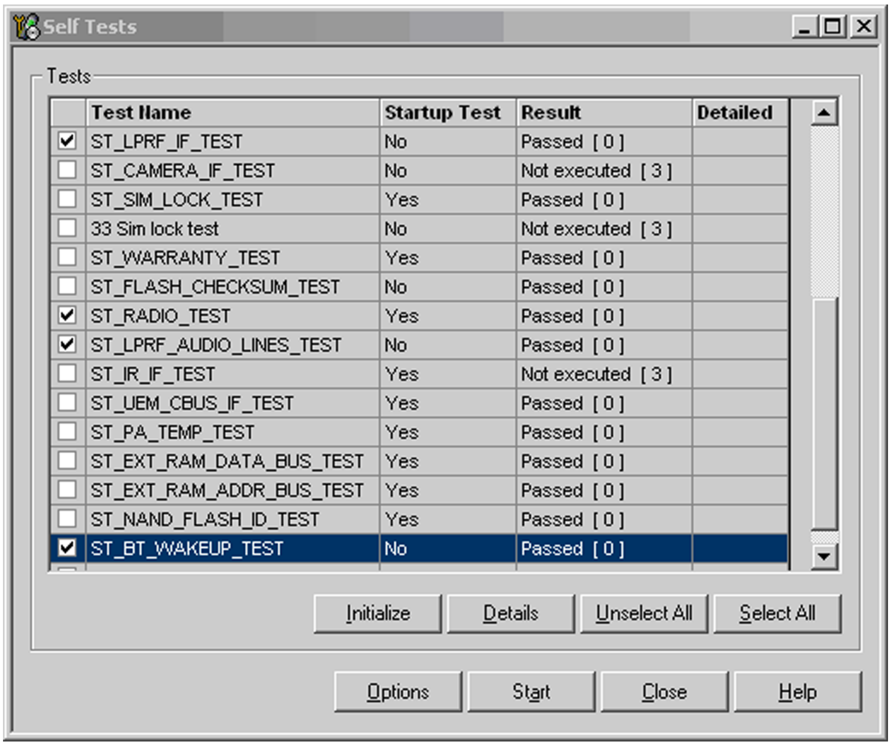
Bluetooth and FM radio self tests in Phoenix

Prerequisites

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File→Scan Product.**
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth and FM radio related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**
   - **ST_RADIO_TEST**
7. To run the tests, click **Start**.



	Test Name	Startup Test	Result	Detailed
☑	ST_LPRF_IF_TEST	No	Passed [0]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Passed [0]	
☐	33 Sim lock test	No	Not executed [3]	
☐	ST_WARRANTY_TEST	Yes	Passed [0]	
☐	ST_FLASH_CHECKSUM_TEST	No	Passed [0]	
☑	ST_RADIO_TEST	Yes	Passed [0]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Passed [0]	
☐	ST_IR_IF_TEST	Yes	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_PA_TEMP_TEST	Yes	Passed [0]	
☐	ST_EXT_RAM_DATA_BUS_TEST	Yes	Passed [0]	
☐	ST_EXT_RAM_ADDR_BUS_TEST	Yes	Passed [0]	
☐	ST_NAND_FLASH_ID_TEST	Yes	Passed [0]	
☑	ST_BT_WAKEUP_TEST	No	Passed [0]	

Figure 19 Bluetooth and FM radio self tests in *Phoenix*

FM radio testing

Steps

1. Set signal generator parameters:
   - FM modulation on
   - Frequency 100MHz

- FM deviation 22kHz
- Modulation frequency 1kHz
- RF level should be varied during the test to obtain good audio signal quality
- Connect suitable antenna to signal generator

  Note: You may alternately use a known good FM radio broadcast as a test signal.

2. Attach the Nokia headset to the phone's AV connector.
3. Use Scroll button to autotune to the radio frequency.
4. Set volume to suitable level.
5. Check audio quality with a headset.

GPS Troubleshooting

GPS components

The GPS componets are located under the RF can, beside the AV-headset connector. There is no need to remove RF can to perform the tests.

GPS Settings for Phoenix

GPS control

Prerequisites

A flash adapter with RF coupler connected to a PC with Phoenix service software is required. The GPS signal should be connected to the RF coupler. The signal level will be high (approx from -45 dBm to -60 dBm) because it is a leakage connection. If possible, calibrate the signal level with a known good phone.

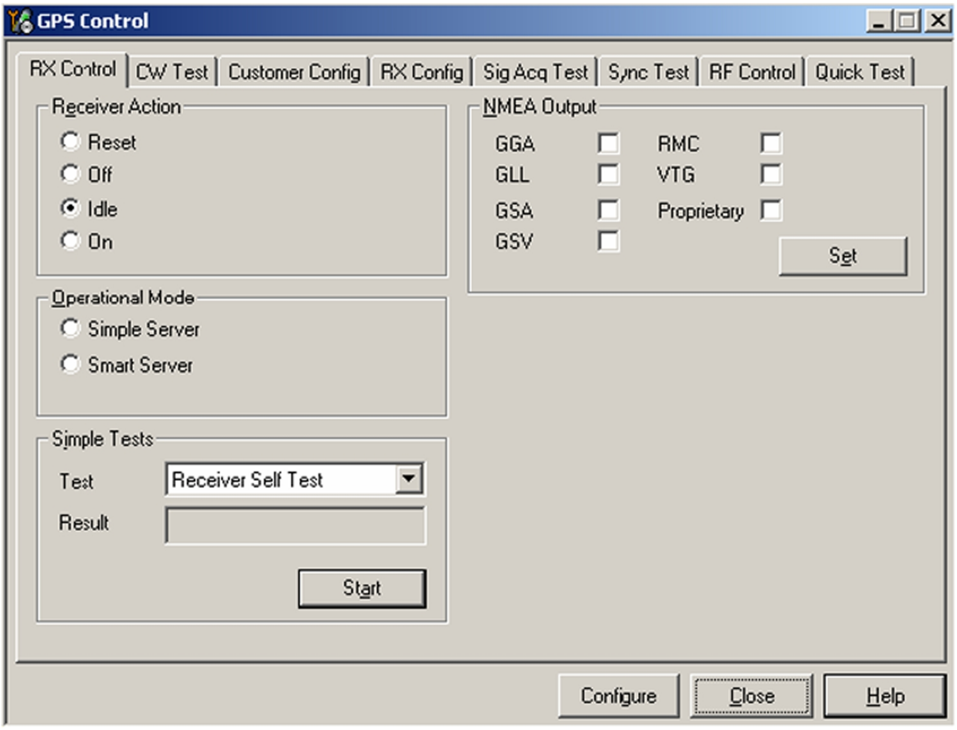
Context

Use the following to test GPS using Phoenix.

Steps

1. Place phone to Flash Adaptor.
2. Start Phoenix service software.
3. From the **File** menu, select **Scan Product** and check that the correct product is displayed.

4. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.


GPS Control
RX Control
CW Test
Customer Config
RX Config
Sig Acq Test
Sync Test
RF Control
Quick Test
Set
Start
Configure
Close
Help

Receiver Action
○ Reset
○ Off
● Idle
○ On

Operational Mode
○ Simple Server
○ Smart Server

Simple Tests
Test: Receiver Self Test
Result:

NMEA Output
GGA ☐
GLL ☐
GSA ☐
GSV ☐
RMC ☐
VTG ☐
Proprietary ☐

Figure 20 GPS Control dialogue box

Testing GPS

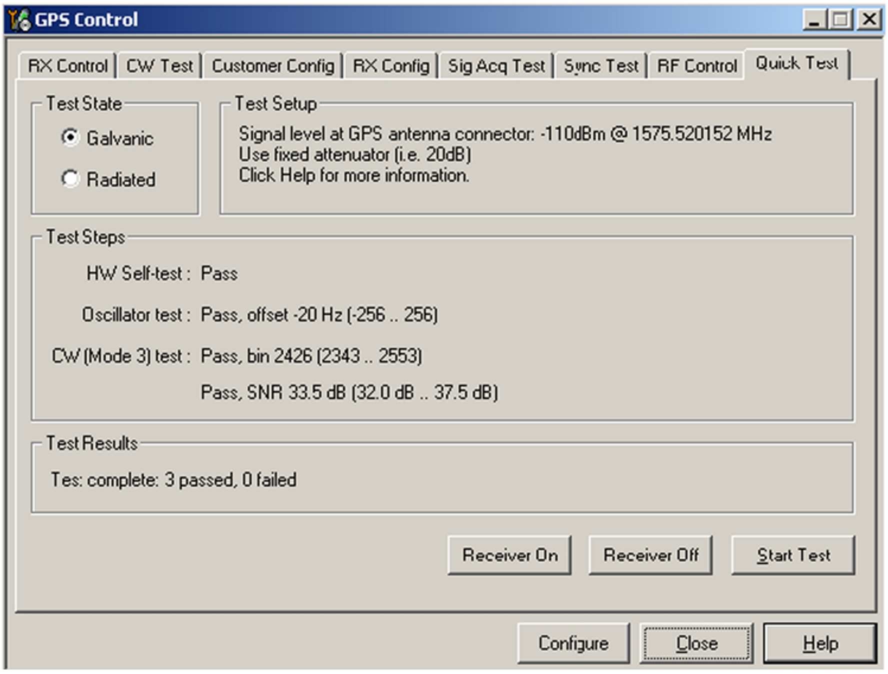
1 Select On to confirm that the GPS is enabled and powered up.

2 6. From the same **RX Control** tab, select from Simple Tests Receiver **Self Test** as a Test case.

  a If it is a pass, proceed to step 7, otherwise proceed.

  b If it is a fail, repeat the test. If it fails again, check connections. If this doesn't help, swap engine module.

3 7. Go to Quick test -tab as shown below.


GPS Control
RX Control
CW Test
Customer Config
RX Config
Sig Acq Test
Sync Test
RF Control
Quick Test
Receiver On
Receiver Off
Start Test
Configure
Close
Help

Test State

● Galvanic

○ Radiated

Test Setup

Signal level at GPS antenna connector: -110dBm @ 1575.520152 MHz
Use fixed attenuator (i.e. 20dB)
Click Help for more information.

Test Steps

HW Self-test : Pass
Oscillator test : Pass, offset -20 Hz (-256 .. 256)
CW (Mode 3) test : Pass, bin 2426 (2343 .. 2553)
Pass, SNR 33.5 dB (32.0 dB .. 37.5 dB)

Test Results

Test complete: 3 passed, 0 failed

Figure 21 GPS Quick Test window

4 Perform the test.

5 In Test Steps box all tests should show pass. If all tests pass, GPS is working properly. Otherwise proseed.

   a If Oscillator test fails, repeat the test couple of times. If it fails again, check connections. If this doesn’t help, swap engine module.

   b If CW (Mode 3) test fails, try to adjust the signal level from generator. In Radioted mode, signal level should be somewhere between -40 dBm to -60 dBm. If CW test fails, swap engine module.

WLAN Troubleshooting

WLAN functional description

The Size 4 WLAN module is designed for use with a single antenna shared between itself and a co-located BT device. The WLAN SW is downloaded from the host engine when the WLAN is turned on over the dedicated SPI interface. BT and WLAN clock is buffered from RF engine.

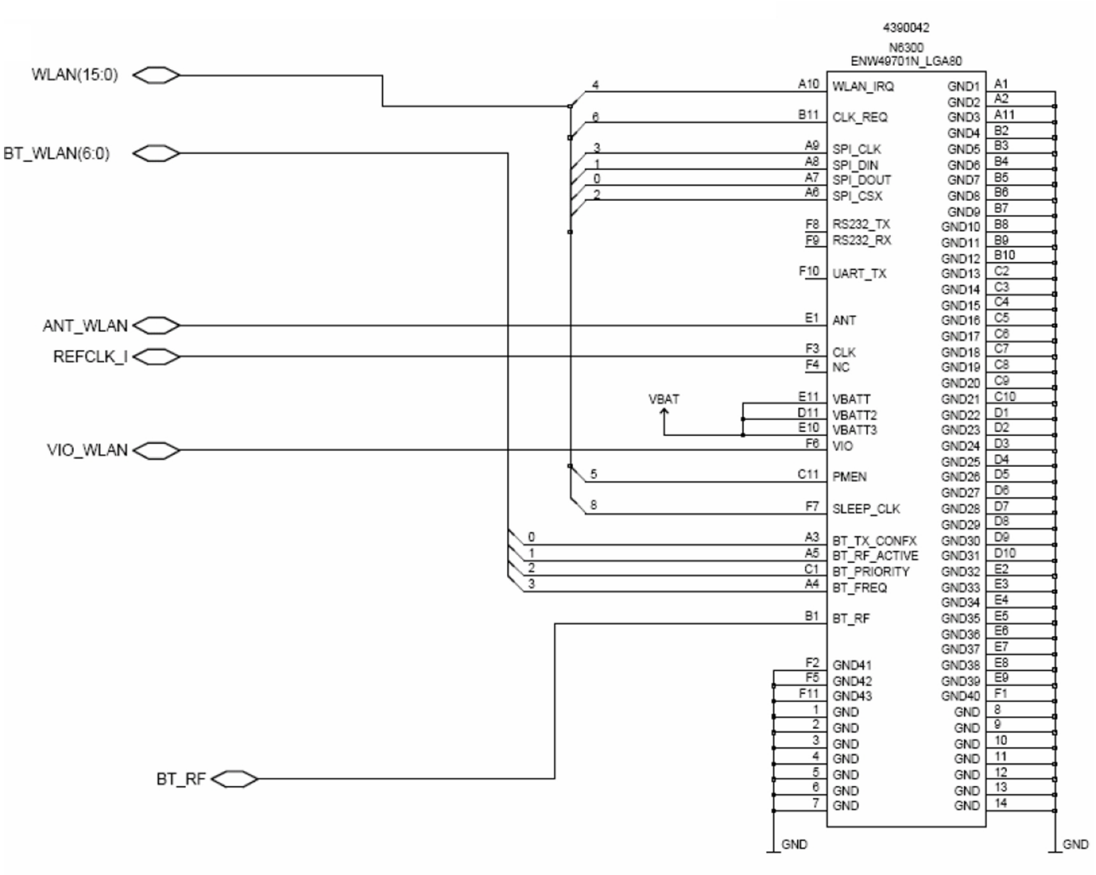

4390042
N6300
ENW49701N_LGA80
WLAN(15:0)
BT_WLAN(6:0)
ANT_WLAN
REFCLK_I
VIO_WLAN
BT_RF
VBAT
WLAN_IRQ
CLK_REQ
SPI_CLK
SPI_DIN
SPI_DOUT
SPI_CSX
RS232_TX
RS232_RX
UART_TX
ANT
CLK
NC
VBATT
VBATT2
VBATT3
VIO
PMEN
SLEEP_CLK
BT_TX_CONFX
BT_RF_ACTIVE
BT_PRIORITY
BT_FREQ
BT_RF
GND41
GND42
GND43
GND

Figure 22 WLAN circuitry

WLAN settings for Phoenix

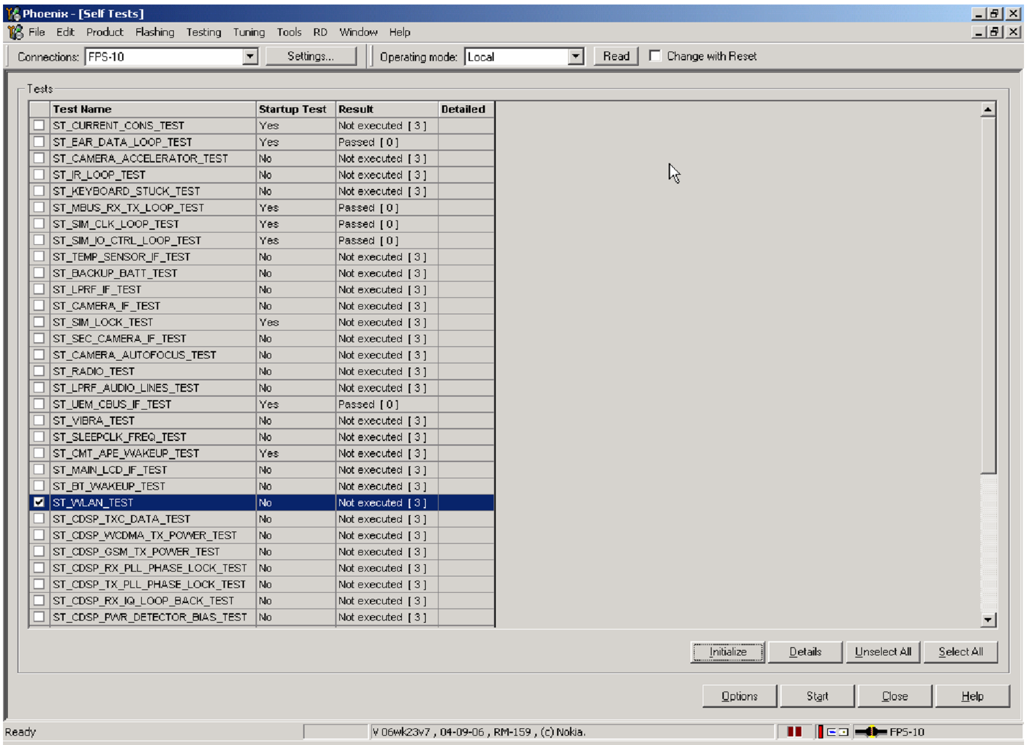
Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

2 From the **File** menu, select **Scan Product** and check that the correct product version is displayed

3 From the **Testing** menu, select **Self Test**. This opens up a Self Test dialogue box, as shown below.

Select the **ST_WLAN_TEST** check box as shown and then select **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.


Phoenix - [Self Tests]
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_CAMERA_ACCELERATOR_TEST	No	Not executed [3]	
☐	ST_IR_LOOP_TEST	No	Not executed [3]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_MBUS_RX_TX_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_TEMP_SENSOR_IF_TEST	No	Not executed [3]	
☐	ST_BACKUP_BATT_TEST	No	Not executed [3]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_SEC_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☑	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	

Ready

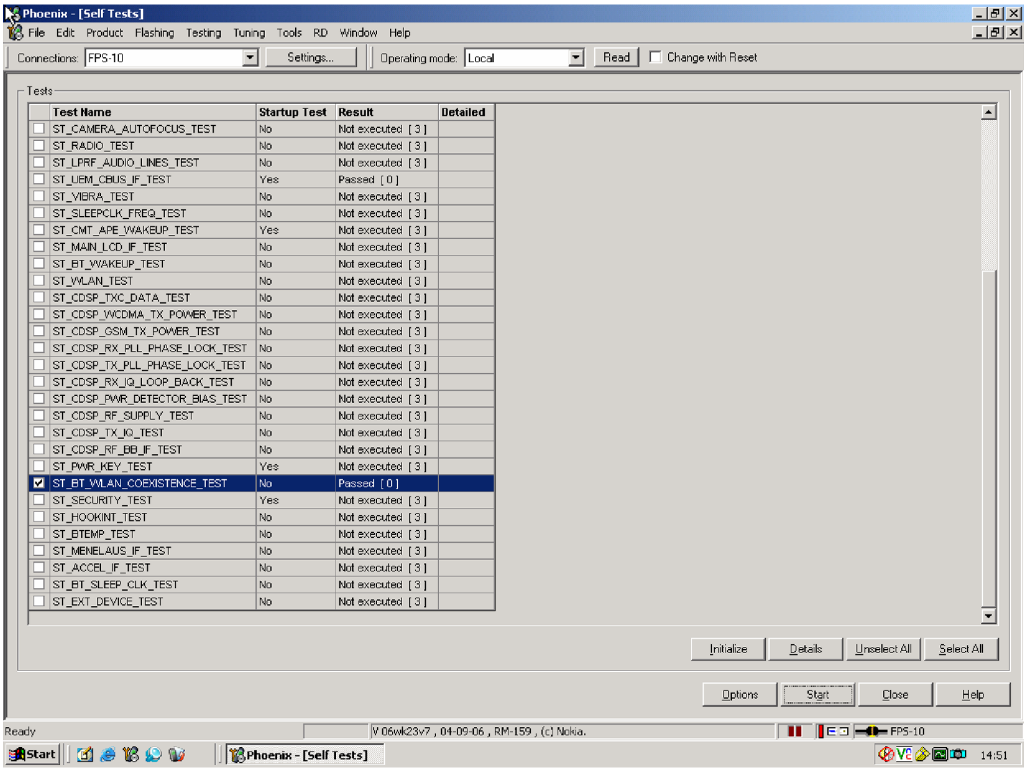
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10

In addition, a test of the WLAN to BTH interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

This test verifies that the WLAN to BTH co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BTH Txconfig, BTH RF Active, BTH Priority, and BTH Frequency.


Phoenix - [Self Tests]
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help
Start
Phoenix - [Self Tests]
14:51

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

	Test Name	Startup Test	Result	Detailed
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_IQ_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Not executed [3]	
☐	ST_PWR_KEY_TEST	Yes	Not executed [3]	
☑	ST_BT_WLAN_COEXISTENCE_TEST	No	Passed [0]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_MENELAUS_IF_TEST	No	Not executed [3]	
☐	ST_ACCEL_IF_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	

Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10

In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BTH. More detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

On/Off test

Prerequisites

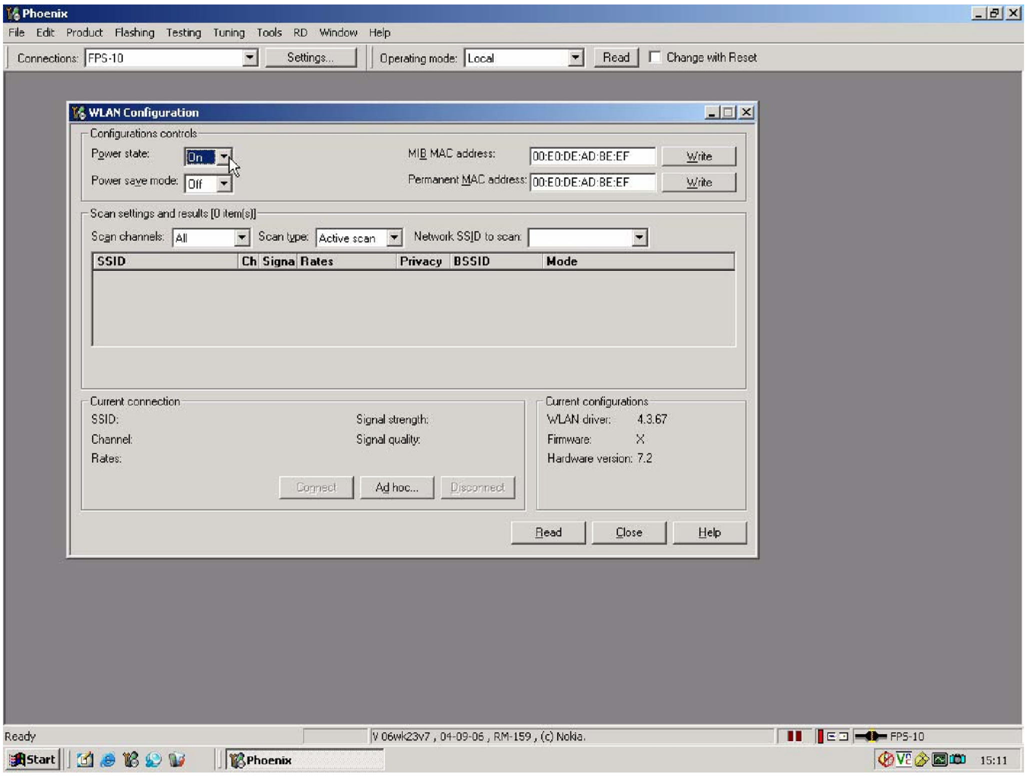
A flash adapter connected to a PC with Phoenix service software is required.

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1 With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.

2 Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 190 to 220mA. When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
WLAN Configuration
Configurations controls
Write
Write
Scan settings and results [0 item(s)]
SSID Ch Signa Rates Privacy BSSID Mode
Current connection
Connect
Ad hoc...
Disconnect
Current configurations
Read
Close
Help
Start
Phoenix
15:11

Connections: FPS-10
Operating mode: Local
☐ Change with Reset

Power state: On
Power save mode: Off
MIB MAC address: 00:E0:DE:AD:BE:EF
Permanent MAC address: 00:E0:DE:AD:BE:EF
Scan channels: All
Scan type: Active scan
Network SSID to scan:

SSID:
Channel:
Rates:
Signal strength:
Signal quality:

WLAN driver: 4.3.67
Firmware: X
Hardware version: 7.2

Ready
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.
FPS-10

TX tests

Prerequisites

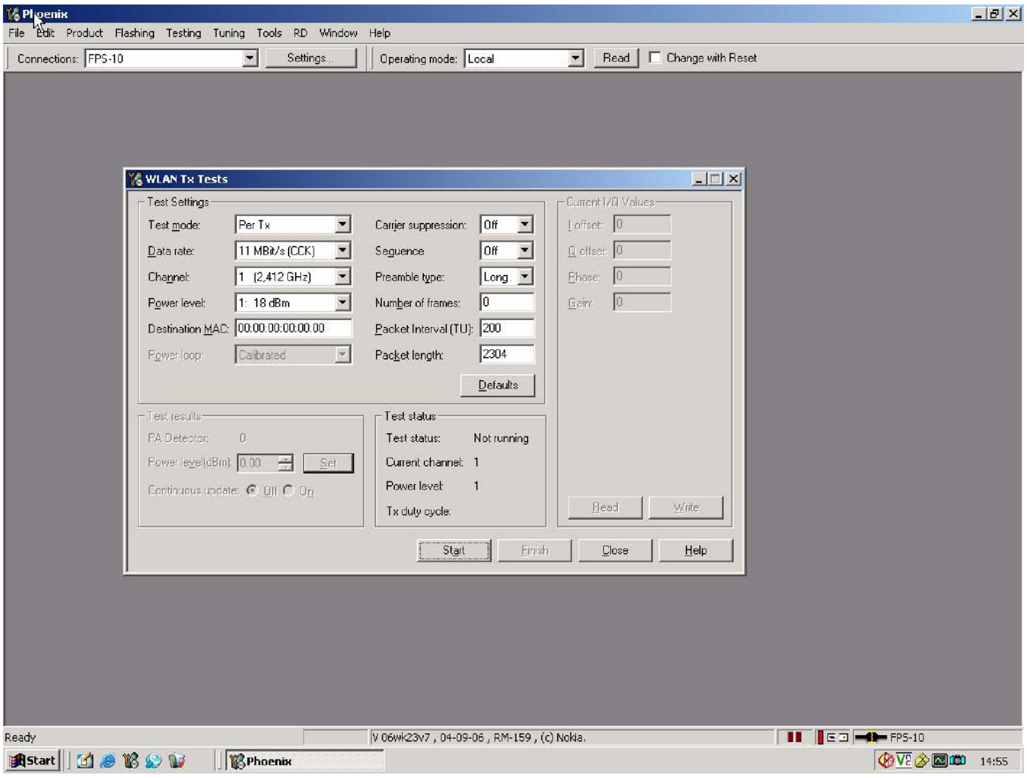
Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

1 Monitor the WLAN TX spectrum on a Spectrum analyser. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result). A typical 11MBPS TX spectrum is shown in figure below.

2 To finish the test select the Finish option button.

The difference between the two readings should be approximately 150mA and measures the transmit current in 11MBPS, 802.11b mode of operation.


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
☐ Change with Reset
WLAN Tx Tests
Defaults
Read
Write
Start
Finish
Close
Help
Start
Phoenix
14:55

Connections: FPS-10

Operating mode: Local

Test Settings

Test mode: Per Tx

Data rate: 11 MBit/s (CCK)

Channel: 1 (2,412 GHz)

Power level: 1: 18 dBm

Destination MAC: 00:00:00:00:00:00

Power loop: Calibrated

Carrier suppression: Off

Sequence: Off

Preamble type: Long

Number of frames: 0

Packet Interval (TU): 200

Packet length: 2304

Current I/Q Values

I offset: 0

Q offset: 0

Phase: 0

Gain: 0

Test results

PA Detector: 0

Power level(dBm): 0.00 Set

Continuous update: ● Off ○ On

Test status

Test status: Not running

Current channel: 1

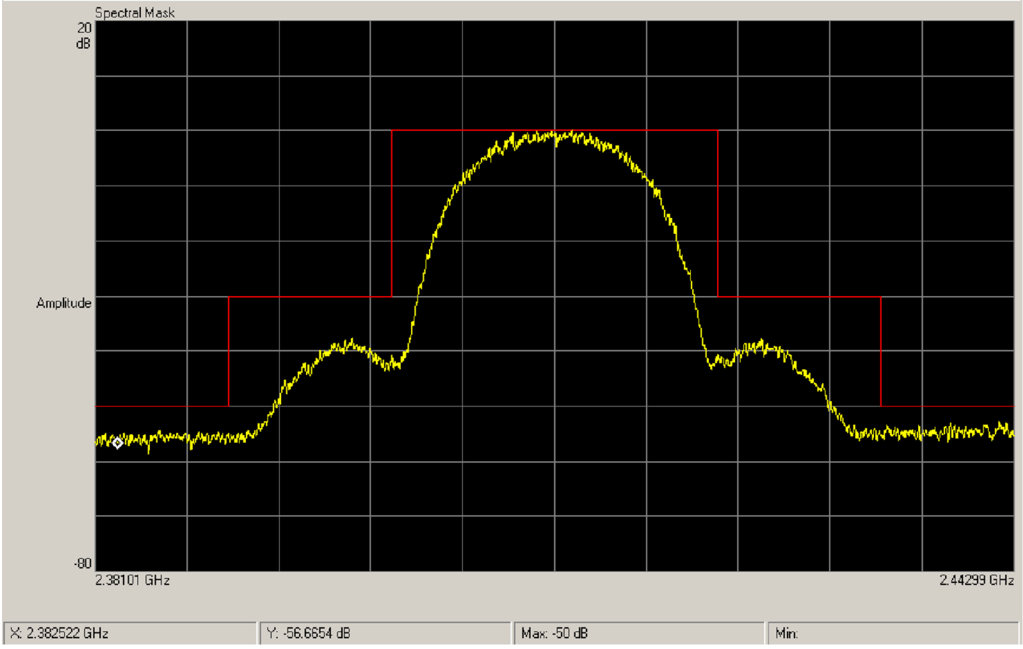
Power level: 1

Tx duty cycle:

Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10



X: 2.382522 GHz

Y: -56.6654 dB

Max: -50 dB

Min:

RX Tests

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

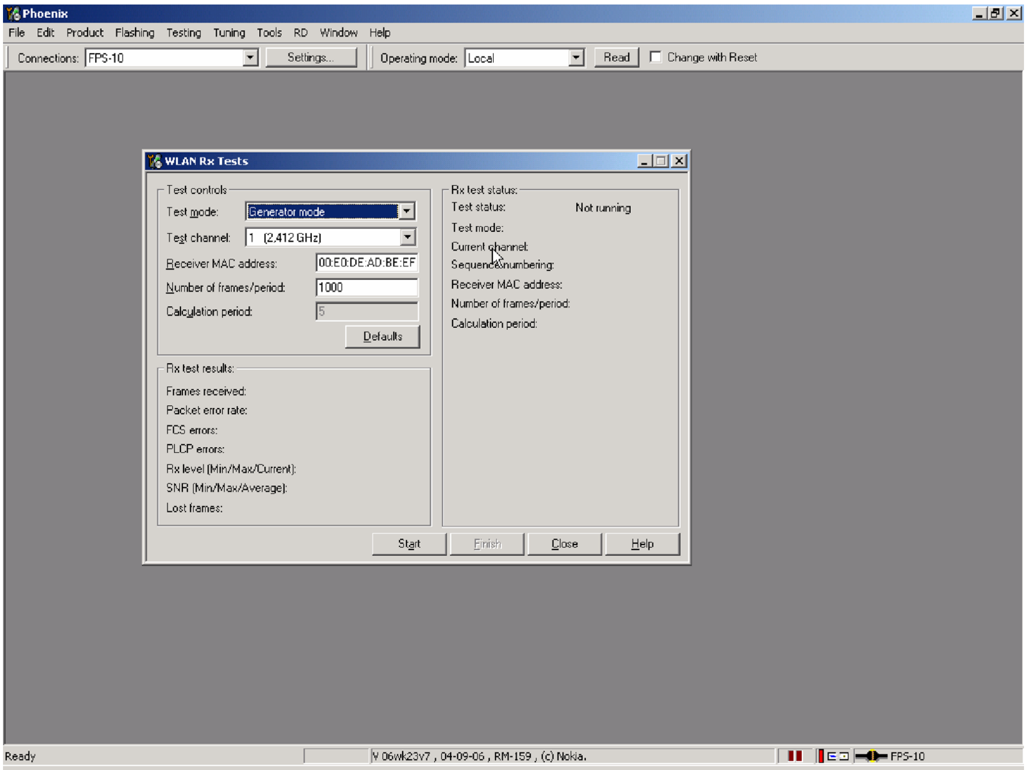
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly.



Connections: FPS-10
Operating mode: Local
☐ Change with Reset

Test mode: Generator mode
Test channel: 1 (2,412 GHz)
Receiver MAC address: 00:E0:DE:AD:BE:EF
Number of frames/period: 1000
Calculation period: 5

Frames received:
Packet error rate:
FCS errors:
PLCP errors:
Rx level (Min/Max/Current):
SNR (Min/Max/Average):
Lost frames:

Test status: Not running
Test mode:
Current channel:
Sequence numbering:
Receiver MAC address:
Number of frames/period:
Calculation period:

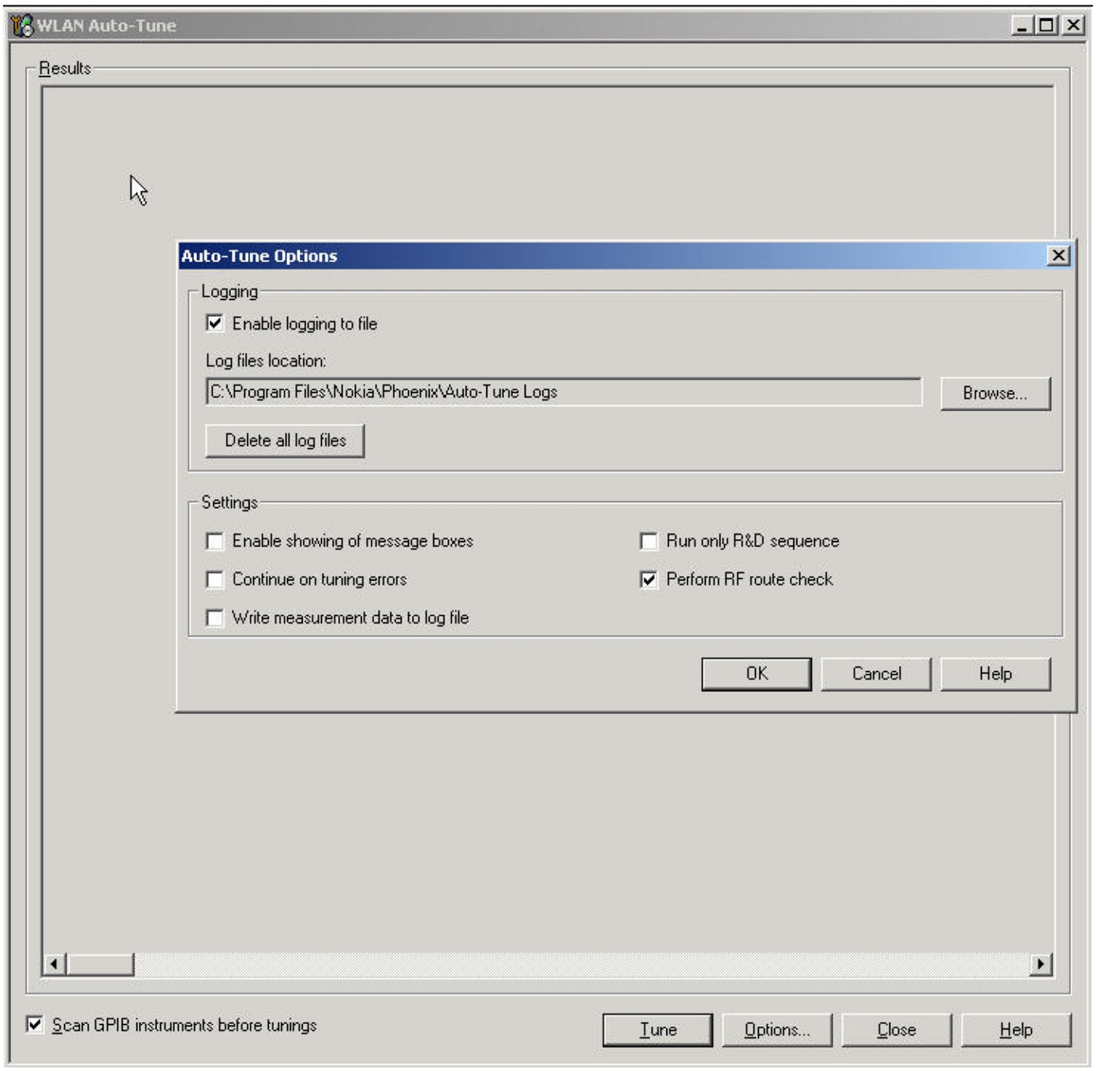
Ready
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.
FPS-10

WLAN auto tuning

In case of WLAN ASIC change, RF power auto tuning is needed. Connect WLAN RF test connector to CMU200 input using proper RF cable. Start Phoenix WLAN autotune window. Check the settings and verify your PC communicates with CMU200 via GPIB.

Auto tuning procedure

1 Start tuning by pressing **Tune**.



WLAN Auto-Tune

Results

Auto-Tune Options

Logging

☑ Enable logging to file

Log files location: C:\Program Files\Nokia\Phoenix\Auto-Tune Logs

Settings

☐ Enable showing of message boxes

☐ Continue on tuning errors

☐ Write measurement data to log file

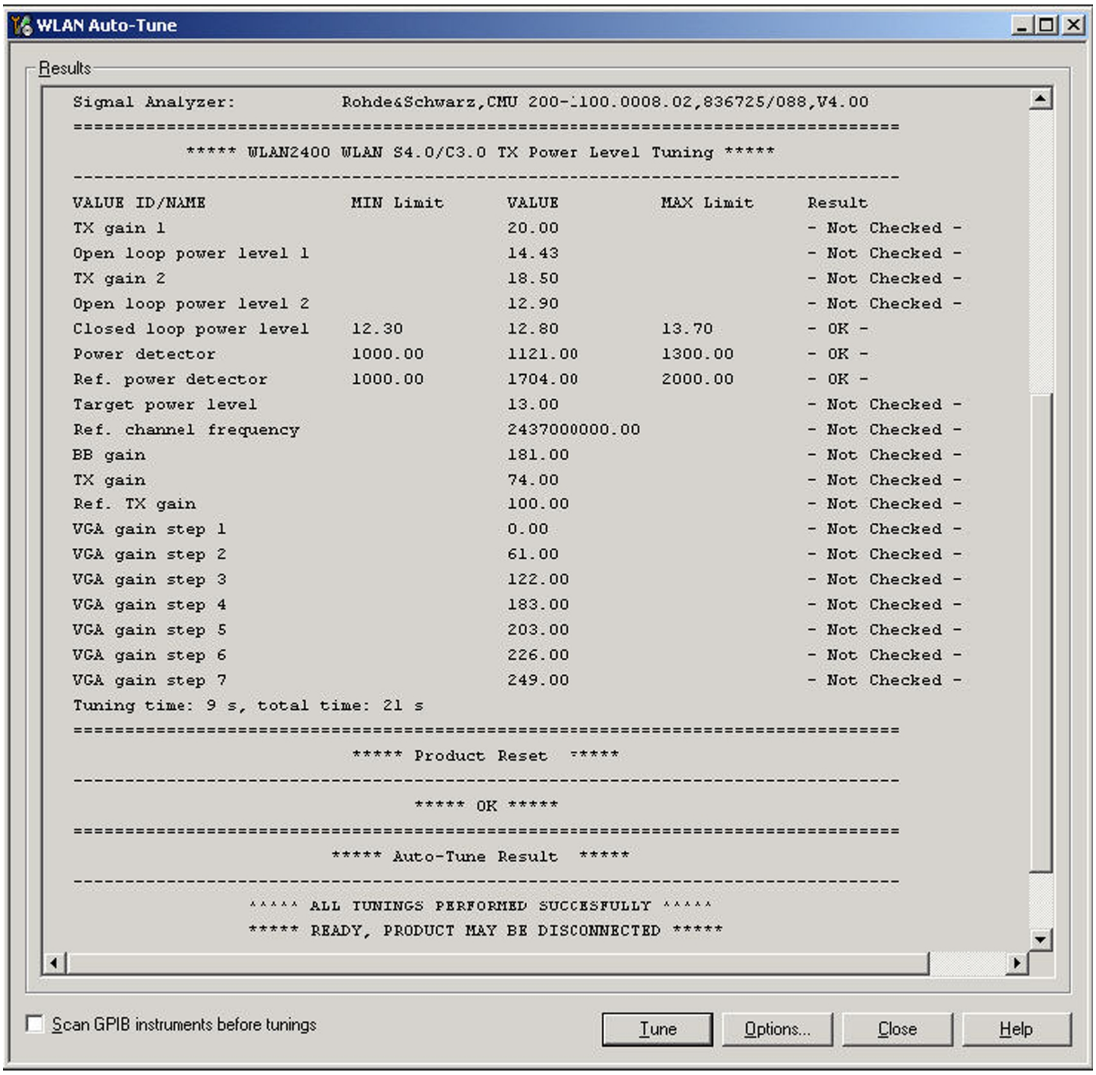
☐ Run only R&D sequence

☑ Perform RF route check

☑ Scan GPIB instruments before tunings

Browse...
Delete all log files
OK
Cancel
Help
Tune
Options...
Close
Help

Figure 23 WLAN auto tune settings



```
Signal Analyzer:          Rohde&Schwarz,CMU 200-1100.0008.02,836725/088,V4.00
================================================================================
           ***** WLAN2400 WLAN S4.0/C3.0 TX Power Level Tuning *****
--------------------------------------------------------------------------------
VALUE ID/NAME              MIN Limit      VALUE          MAX Limit     Result
TX gain 1                                 20.00                        - Not Checked -
Open loop power level 1                   14.43                        - Not Checked -
TX gain 2                                 18.50                        - Not Checked -
Open loop power level 2                   12.90                        - Not Checked -
Closed loop power level    12.30          12.80          13.70         - OK -
Power detector             1000.00        1121.00        1300.00       - OK -
Ref. power detector        1000.00        1704.00        2000.00       - OK -
Target power level                        13.00                        - Not Checked -
Ref. channel frequency                    2437000000.00                - Not Checked -
BB gain                                   181.00                       - Not Checked -
TX gain                                   74.00                        - Not Checked -
Ref. TX gain                              100.00                       - Not Checked -
VGA gain step 1                           0.00                         - Not Checked -
VGA gain step 2                           61.00                        - Not Checked -
VGA gain step 3                           122.00                       - Not Checked -
VGA gain step 4                           183.00                       - Not Checked -
VGA gain step 5                           203.00                       - Not Checked -
VGA gain step 6                           226.00                       - Not Checked -
VGA gain step 7                           249.00                       - Not Checked -
Tuning time: 9 s, total time: 21 s
================================================================================
                           ***** Product Reset  *****
--------------------------------------------------------------------------------
                                 ***** OK *****
================================================================================
                         ***** Auto-Tune Result  *****
--------------------------------------------------------------------------------
                 ***** ALL TUNINGS PERFORMED SUCCESFULLY *****
                 ***** READY, PRODUCT MAY BE DISCONNECTED *****
```

Figure 24 WLAN auto tune results

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4 — RF Troubleshooting

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General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

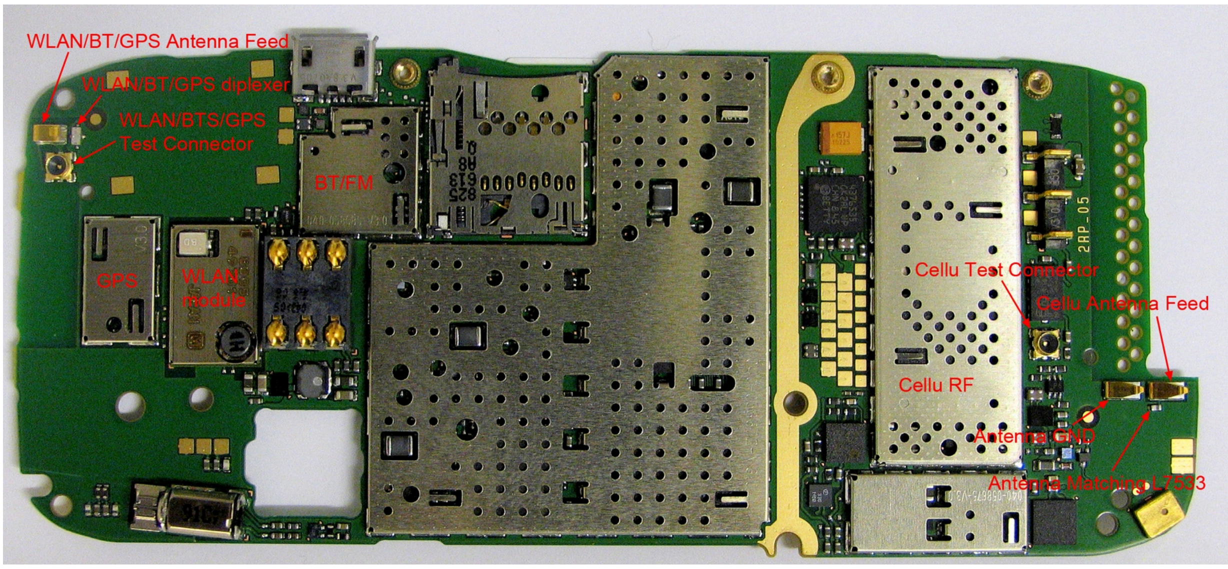
> **Note:** A mobile phone WCDMA transmitter should never be tested with full TX power (it is only possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
>
> **Note:** All communication Test Set Screen dumps are from CMU200. Other testers are different.
>
> **Note:** All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to verify functionality of the cellular RF block without removing RF shield.

RF key components and test points

RF key components and test point graphics for RM-465.


WLAN/BT/GPS Antenna Feed
WLAN/BT/GPS diplexer
WLAN/BTS/GPS Test Connector
BT/FM
GPS
WLAN module
Cellu Test Connector
Cellu Antenna Feed
Cellu RF
Antenna GND
Antenna Matching L7533

■ Auto tuning

Introduction to RF tunings

RF tuning is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the tuning phase will cause a complete mistuning of the RF part.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup. For RF attenuations of the module jig and RF cable, please refer to the Service Tools section.

Auto tuning

This phone can be tuned automatically.

Auto tuning is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

For hardware requirements for auto tuning, please refer to *Service concept for RF testing and RF/BB tuning*.

Phoenix preparations

Install the phone specific data package, for example *RM-465_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Otherwise some menus will not be shown in Phoenix.

2 To go to autotune, select **Tuning (Alt-U)**→**Auto-Tune (Alt-A)** from the menu.

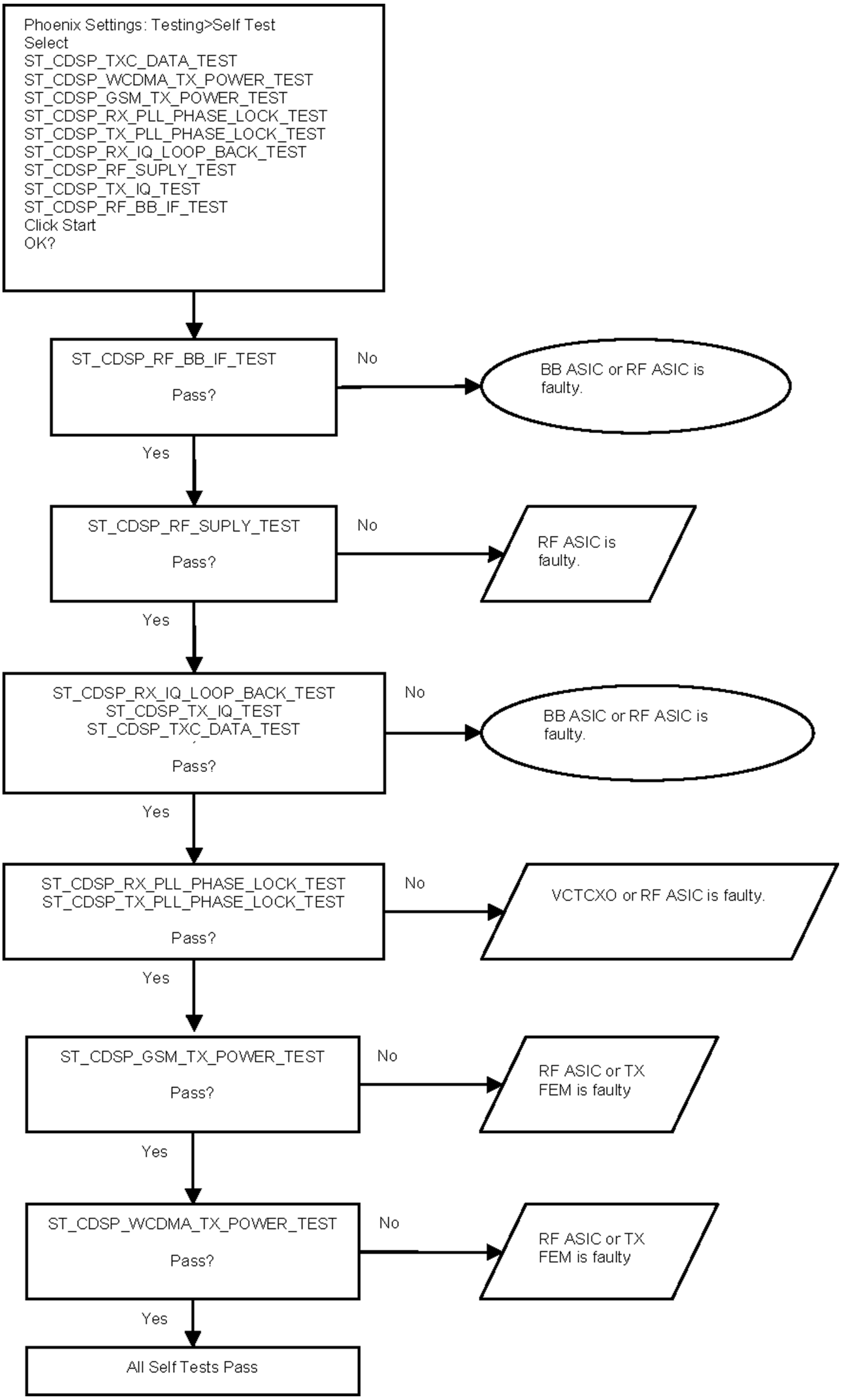
3 Start autotuning by clicking the *Tune* button.

■ Self Test Troubleshooting

Self test troubleshooting

Troubleshooting flow

Note: Self tests are recommended to be made when phone is in jig and 50 Ohm load is connected to RF connector. Otherwise powertests may fail depending on antenna load.


Phoenix Settings: Testing>Self Test
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_RF_SUPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click Start
OK?
ST_CDSP_RF_BB_IF_TEST
Pass?
No
BB ASIC or RF ASIC is faulty.
Yes
ST_CDSP_RF_SUPLY_TEST
Pass?
No
RF ASIC is faulty.
Yes
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_TXC_DATA_TEST
Pass?
No
BB ASIC or RF ASIC is faulty.
Yes
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
Pass?
No
VCTCXO or RF ASIC is faulty.
Yes
ST_CDSP_GSM_TX_POWER_TEST
Pass?
No
RF ASIC or TX FEM is faulty
Yes
ST_CDSP_WCDMA_TX_POWER_TEST
Pass?
No
RF ASIC or TX FEM is faulty
Yes
All Self Tests Pass

Receiver Troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*. For a similar test in WCDMA mode, see *WCDMA RSSI measurement*.

GSM RX chain activation for manual measurements/GSM RSSI measurement

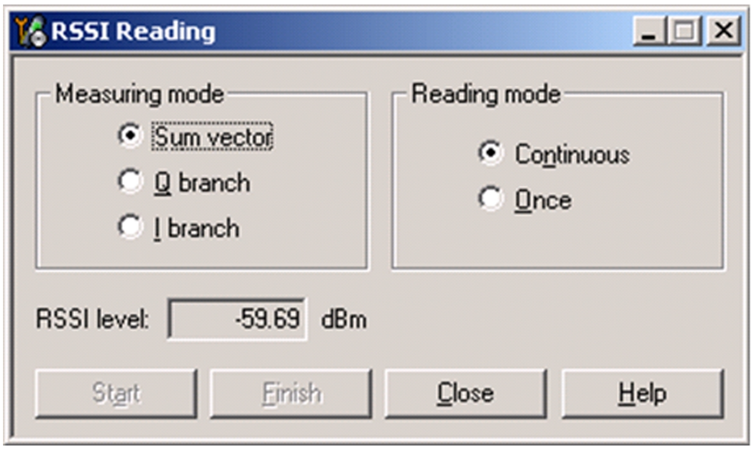
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz	942.46771MHz	1842.86771MHz	1960.06771MHz
	(67.71kHz offset)	(67.71kHz offset)	(67.71kHz offset)	(67.71kHz offset)
	at -60dBm	at -60dBm	at -60dBm	at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

Figure 25 Phoenix GSM RSSI reading window

Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

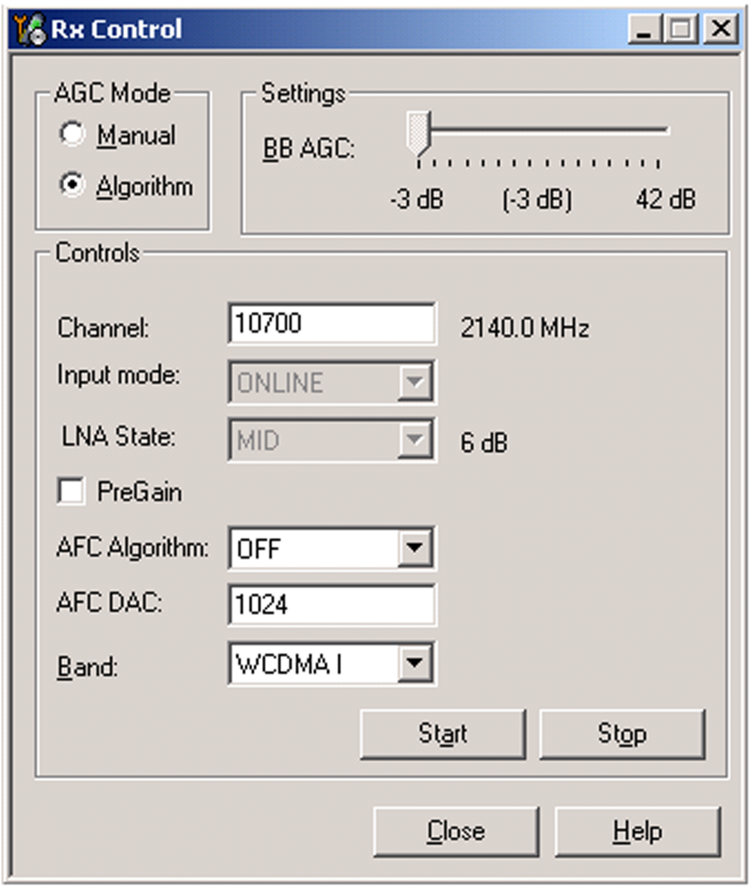
When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

Note: In case of fail result, most probably RF ASIC or TX FEM is faulty.

WCDMA RX chain activation for manual measurement

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



AGC Mode
○ Manual
● Algorithm

Settings
BB AGC: -3 dB (-3 dB) 42 dB

Controls
Channel: 10700 2140.0 MHz
Input mode: ONLINE
LNA State: MID 6 dB
☐ PreGain
AFC Algorithm: OFF
AFC DAC: 1024
Band: WCDMA I

Figure 26 Phoenix WCDMA RX Control window

Note: Channel for band WCDMA II 9800, VIII 3012

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

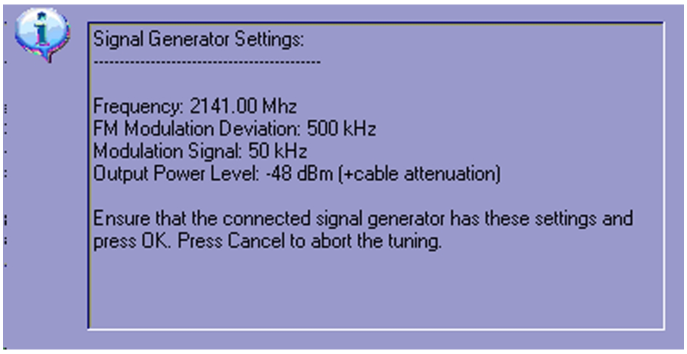
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation. Connect signal generator to RF connector and use appropriate frequency for each channel (2141 MHz for channel 10700 WCDMA band I, WCDMA modulation).

Steps

1. Set the following RF generator settings:



Signal Generator Settings:

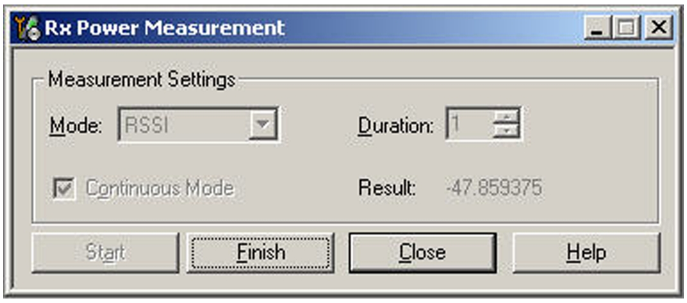
Frequency: 2141.00 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 27 WCDMA RX generator settings

Note: Frequency for band WCDMA II 1961.0MHz, VIII 943.4MHz

2. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
3. In the RX power measurement window, make the following settings:



Measurement Settings
Mode: RSSI
Duration: 1
☑ Continuous Mode
Result: -47.859375

Figure 28 Phoenix WCDMA RX power measurement window

4. Click **Start** to perform the measurement.

   Note: WCDMA RSSI measurement is accurate only with WCDMA modulated signal.

Transmitter Troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use.
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”, in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production.

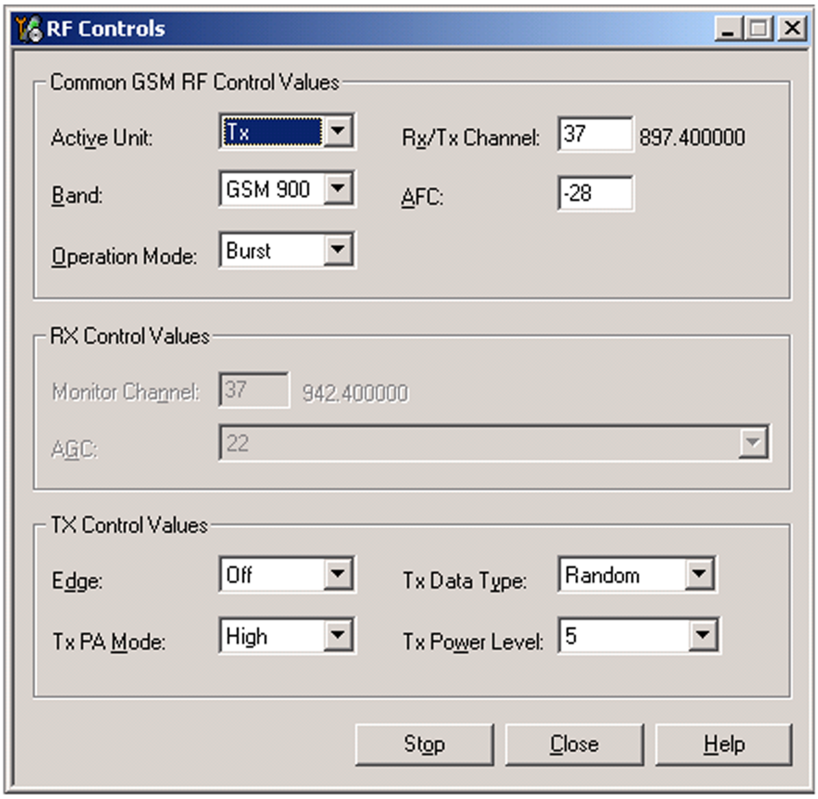
  Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Make settings as shown in the figure:



Common GSM RF Control Values

Active Unit: Tx

Band: GSM 900

Operation Mode: Burst

Rx/Tx Channel: 37 897.400000

AFC: -28

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx PA Mode: High

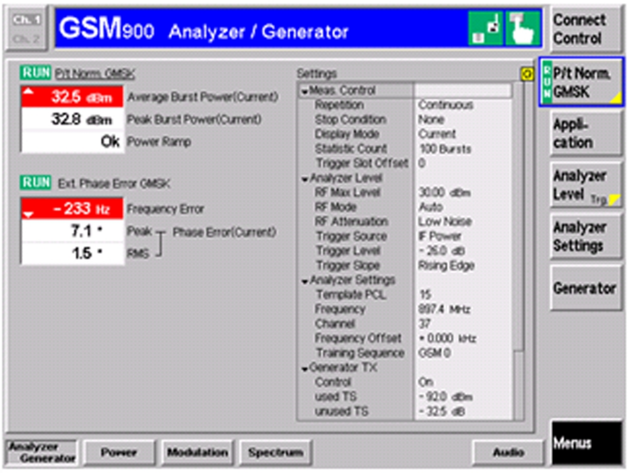
Tx Data Type: Random

Tx Power Level: 5

Figure 29 Phoenix GSM RF controls window

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings

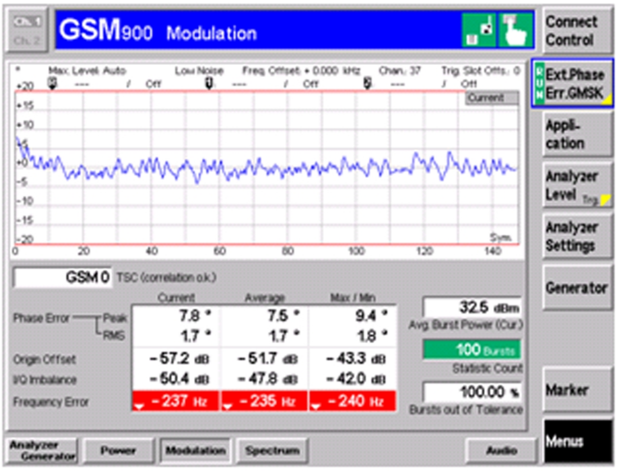

Ch. 1
Ch. 2
GSM900 Analyzer / Generator
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

RUN P/t Norm. GMSK
32.5 dBm Average Burst Power(Current)
32.8 dBm Peak Burst Power(Current)
Ok Power Ramp

RUN Ext. Phase Error GMSK
-233 Hz Frequency Error
7.1 ° Peak ┐ Phase Error(Current)
1.5 ° RMS ┘

Settings
- Meas. Control
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current
  - Statistic Count: 100 Bursts
  - Trigger Slot Offset: 0
- Analyzer Level
  - RF Max Level: 30.00 dBm
  - RF Mode: Auto
  - RF Attenuation: Low Noise
  - Trigger Source: IF Power
  - Trigger Level: -26.0 dB
  - Trigger Slope: Rising Edge
- Analyzer Settings
  - Template PCL: 15
  - Frequency: 897.4 MHz
  - Channel: 37
  - Frequency Offset: +0.000 kHz
  - Training Sequence: GSM 0
- Generator TX
  - Control: On
  - used TS: -92.0 dBm
  - unused TS: -32.5 dB

Phase error

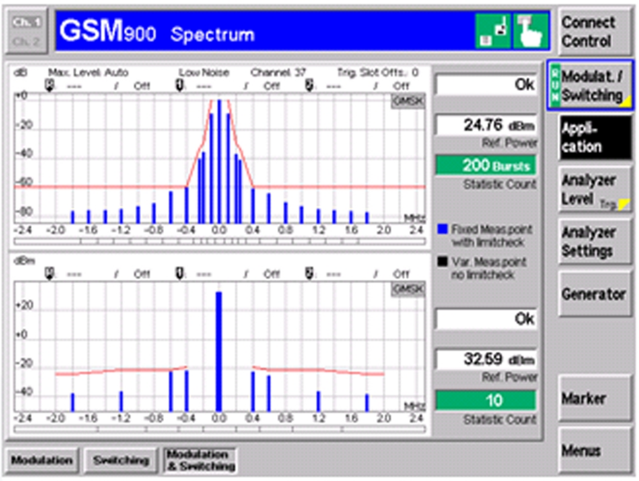

Ch. 1
Ch. 2
GSM900 Modulation
Max. Level Auto
Low Noise
Freq. Offset +0.000 kHz
Chan. 37
Trig. Slot Offs. 0
Off
Current
+20
+15
+10
+5
+0
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140
Connect Control
Ext.Phase Err.GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		-57.2 dB	-51.7 dB	-43.3 dB
I/Q Imbalance		-50.4 dB	-47.8 dB	-42.0 dB
Frequency Error		-237 Hz	-235 Hz	-240 Hz

32.5 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

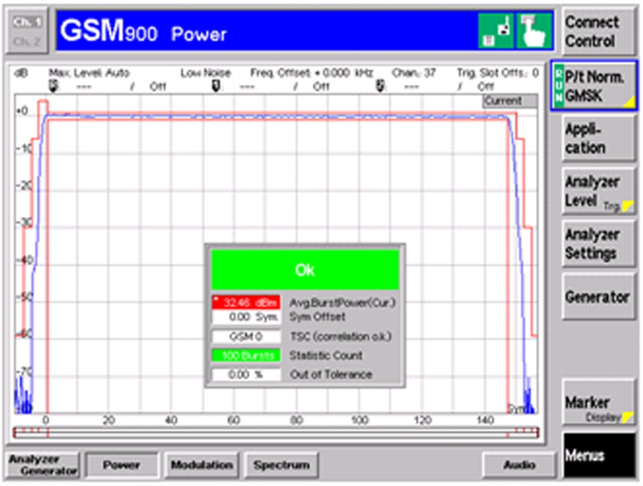
Modulation/Switching spectrum


Ch. 1
Ch. 2
GSM900 Spectrum
dB
Max. Level Auto
Low Noise
Channel 37
Trig. Slot Offs. 0
Off
GMSK
+0
-20
-40
-60
-80
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
dBm
+20
+0
-20
-40
Fixed Meas.point with limitcheck
Var. Meas.point no limitcheck
Connect Control
Modulat. / Switching
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
Modulation
Switching
Modulation & Switching

OK
24.76 dBm Ref. Power
200 Bursts Statistic Count

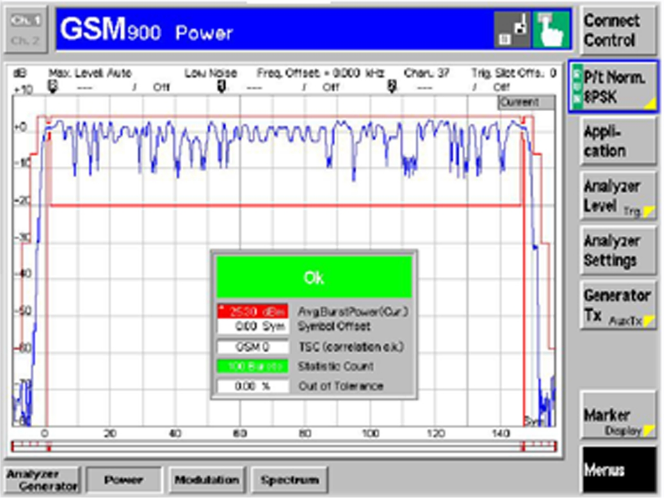
OK
32.59 dBm Ref. Power
10 Statistic Count

Power/Burst GSM/GPRS (GMSK)


Ch. 1
Ch. 2
GSM900 Power
dB
Max. Level Auto
Low Noise
Freq. Offset +0.000 kHz
Chan. 37
Trig. Slot Offs. 0
Off
Current
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker Display
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

Ok
32.46 dBm AvgBurstPower(Cur.)
0.00 Sym. Sym Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Power/Burst - EDGE (8PSK)


Ch. 1
Ch. 2
GSM900 Power
dB
Max. Level Auto
Low Noise
Freq. Offset +0.000 kHz
Chan. 37
Trig. Slot Offs. 0
Off
Current
+10
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Connect Control
P/t Norm. 8PSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator Tx AuxTx
Marker Display
Menus
Analyzer Generator
Power
Modulation
Spectrum

Ok
25.30 dBm AvgBurstPower(Cur.)
0.00 Sym Symbol Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

4. Change power level (RF controls) and make sure the power reading follows accordingly.

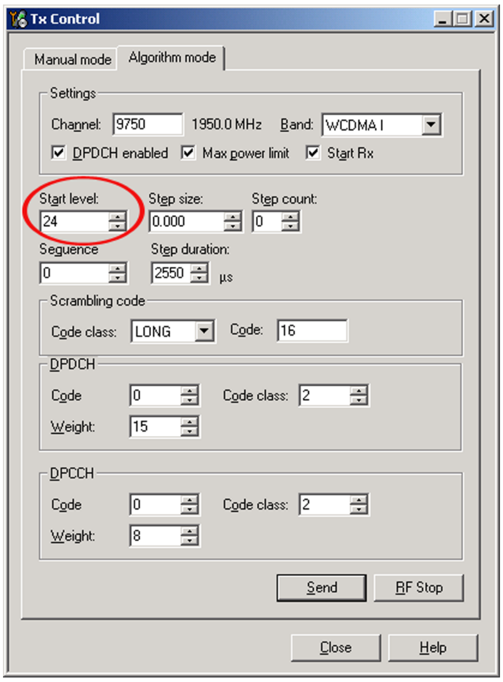
Next actions

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings as in the picture:



Settings

Channel: 9750 1950.0 MHz Band: WCDMA I

☑ DPDCH enabled ☑ Max power limit ☑ Start Rx

Start level: 24

Step size: 0.000

Step count: 0

Sequence: 0

Step duration: 2550 µs

Scrambling code

Code class: LONG Code: 16

DPDCH

Code: 0 Code class: 2

Weight: 15

DPCCH

Code: 0 Code class: 2

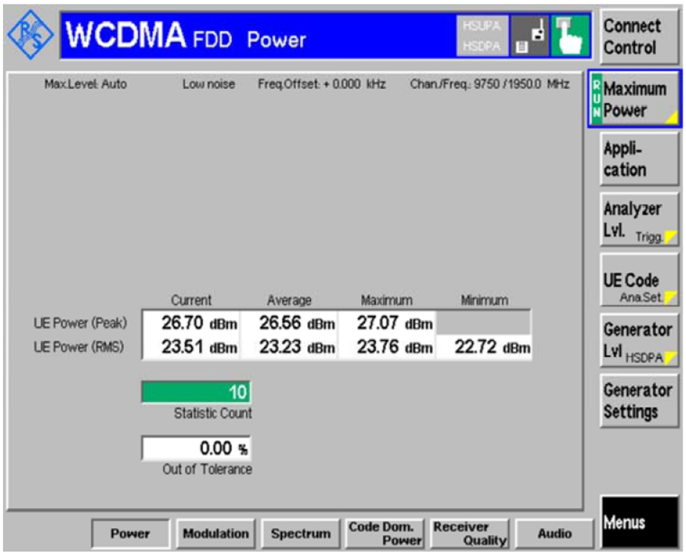
Weight: 8

Note: For WCDMA TX channels: band VIII 2787

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.
5. Check the basic TX parameters using a communication analyzer (for example CMU200).

Power

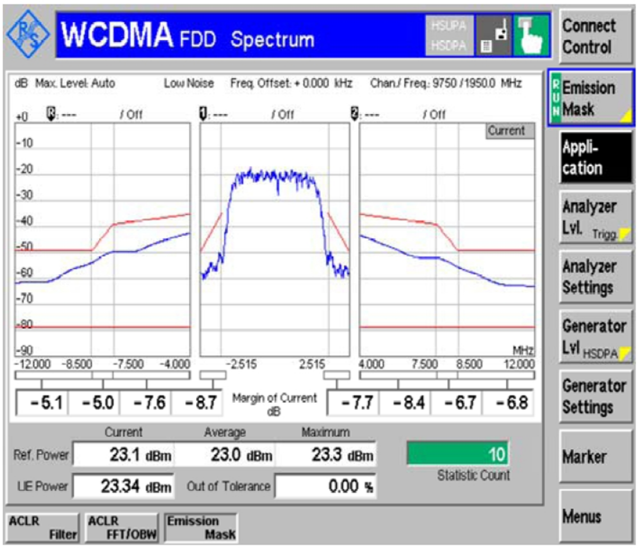

WCDMA FDD Power
HSUPA
HSDPA
Connect Control
Maximum Power
Appli-cation
Analyzer Lvl. Trigg.
UE Code Ana.Set.
Generator Lvl HSDPA
Generator Settings
Menus
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality
Audio

Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9750 / 1950.0 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	26.70 dBm	26.56 dBm	27.07 dBm	
UE Power (RMS)	23.51 dBm	23.23 dBm	23.76 dBm	22.72 dBm

Statistic Count: 10
Out of Tolerance: 0.00 %

Spectrum - Emission Mask


WCDMA FDD Spectrum
HSUPA
HSDPA
Connect Control
Emission Mask
Appli-cation
Analyzer Lvl. Trigg.
Analyzer Settings
Generator Lvl HSDPA
Generator Settings
Marker
Menus
ACLR Filter
ACLR FFT/OBW
Emission Mask
Current
dB
+0
-10
-20
-30
-40
-50
-60
-70
-80
-90
MHz
-12.000
-8.500
-7.500
-4.000
-2.515
2.515
4.000
7.500
8.500
12.000

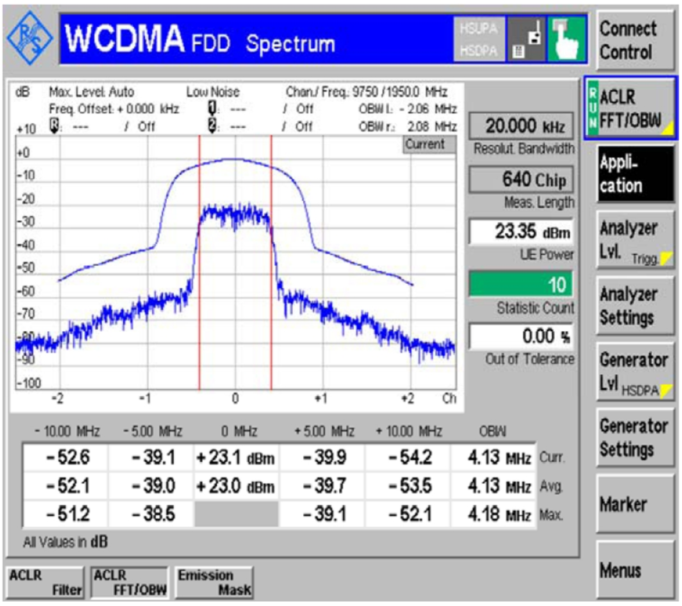
dB Max. Level: Auto Low Noise Freq. Offset: + 0.000 kHz Chan./Freq.: 9750 / 1950.0 MHz

Margin of Current dB: -5.1 -5.0 -7.6 -8.7 | -7.7 -8.4 -6.7 -6.8

	Current	Average	Maximum
Ref. Power	23.1 dBm	23.0 dBm	23.3 dBm
UE Power	23.34 dBm		

Out of Tolerance: 0.00 %
Statistic Count: 10

Spectrum - ACLR (FFT/OBW)


WCDMA FDD Spectrum
HSUPA
HSDPA
Connect Control
ACLR FFT/OBW
Appli-cation
Analyzer Lvl. Trigg.
Analyzer Settings
Generator Lvl HSDPA
Generator Settings
Marker
Menus
ACLR Filter
ACLR FFT/OBW
Emission Mask
Current
dB
+10
+0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-2
-1
0
+1
+2
Ch

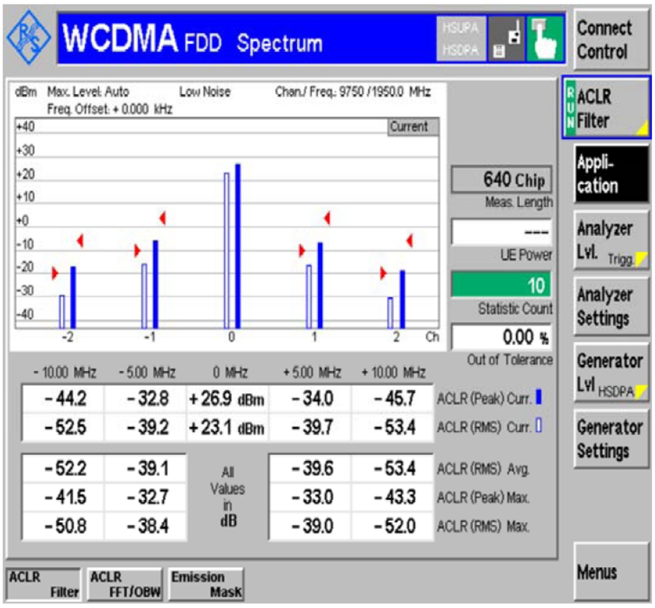
dB Max. Level: Auto Low Noise Chan./Freq.: 9750 / 1950.0 MHz
Freq. Offset: + 0.000 kHz OBW l: - 2.06 MHz OBW r: 2.08 MHz

Resol. Bandwidth: 20.000 kHz
Meas. Length: 640 Chip
UE Power: 23.35 dBm
Statistic Count: 10
Out of Tolerance: 0.00 %

-10.00 MHz	-5.00 MHz	0 MHz	+5.00 MHz	+10.00 MHz	OBW	
-52.6	-39.1	+23.1 dBm	-39.9	-54.2	4.13 MHz	Curr.
-52.1	-39.0	+23.0 dBm	-39.7	-53.5	4.13 MHz	Avg.
-51.2	-38.5		-39.1	-52.1	4.18 MHz	Max.

All Values in dB

Spectrum - ACLR (Filter)


WCDMA FDD Spectrum
HSUPA
HSDPA
Connect Control
ACLR Filter
Appli-cation
Analyzer Lvl. Trigg.
Analyzer Settings
Generator Lvl HSDPA
Generator Settings
Menus
ACLR Filter
ACLR FFT/OBW
Emission Mask
Current
+40
+30
+20
+10
+0
-10
-20
-30
-40
-2
-1
0
1
2
Ch

dBm Max. Level: Auto Low Noise Chan./Freq.: 9750 / 1950.0 MHz
Freq. Offset: + 0.000 kHz

Meas. Length: 640 Chip
UE Power: ---
Statistic Count: 10
Out of Tolerance: 0.00 %

-10.00 MHz	-5.00 MHz	0 MHz	+5.00 MHz	+10.00 MHz	
-44.2	-32.8	+26.9 dBm	-34.0	-45.7	ACLR (Peak) Curr.
-52.5	-39.2	+23.1 dBm	-39.7	-53.4	ACLR (RMS) Curr.
-52.2	-39.1	All Values in dB	-39.6	-53.4	ACLR (RMS) Avg.
-41.5	-32.7		-33.0	-43.3	ACLR (Peak) Max.
-50.8	-38.4		-39.0	-52.0	ACLR (RMS) Max.

Next actions

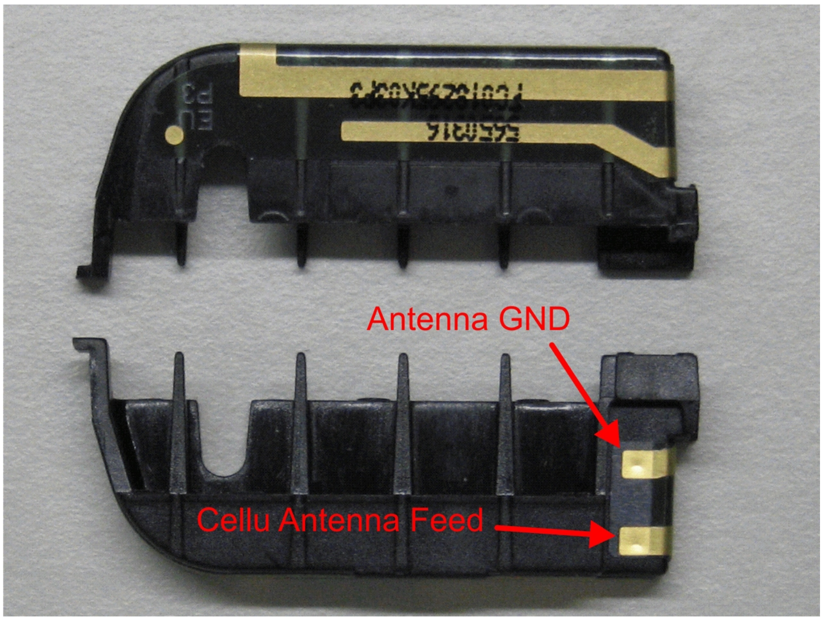
If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

Antenna Troubleshooting

Antenna troubleshooting

Antenna contacts, visual check

In the main antenna there is one feed and one GND contact. Check that GND and feed pads take proper contact to the C-clips on main PWB.


Antenna GND
Cellu Antenna Feed

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5 — Camera Module Troubleshooting

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Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1. Camera is not functional at all; no image can be taken.
2. Images can be taken but there is nothing recognizable in them.
3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded, or customer complains about image quality.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong, or is there anything wrong at all.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference. Experience helps significantly in analysing image quality.

Terms

Autofocus	Camera module contains lens movement mechanics for focus adjustment. Autofocus enables camera to take sharp images of objects positioned between 10cm to infinity. During AF the viewfinder image will be momentarily blurred as the camera searches for the right focus setting.
Digital zoom	Digital zoom is done by first cropping the image by the zoom ratio and then upscaling it to the output resolution. This will decrease the image quality especially with high zoom ratios.
Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
ND-filter	Neutral density filter is a filter which is used in very bright conditions to reduce the amount of light hitting the sensor. The filter is built into the camera module and applied automatically when needed.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor. In some occasions the term resolution is used for describing the sharpness of the images.

Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.
Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.
Shutter	The electronic shutter is used when short exposure times are needed and in video. When the mechanical shutter is used a black sheet will cover the lens after the exposure.

The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera operation and are not a reason for changing the camera module.

Autofocus

When the camera is focusing a lens is moved inside the module to give the sharpest possible image. This camera module is specified to operate satisfactorily from 10 cm to infinite distance of scene objects. Trying to photograph objects closer than 10 cm is likely to result in a blurred out of focus image. The lack of sharpness is first visible in full resolution images. Images taken very close to the subject, a limited depth of focus will be visible, that is the upper or lower parts of the image may be out of focus. This is normal; do not change the camera module.

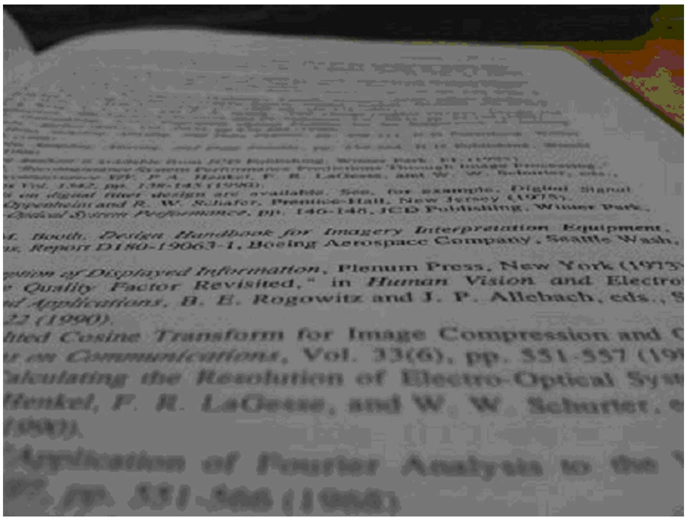


Figure 30 Only center part of image is in focus due to limited depth of focus

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in the night mode is ¼ seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

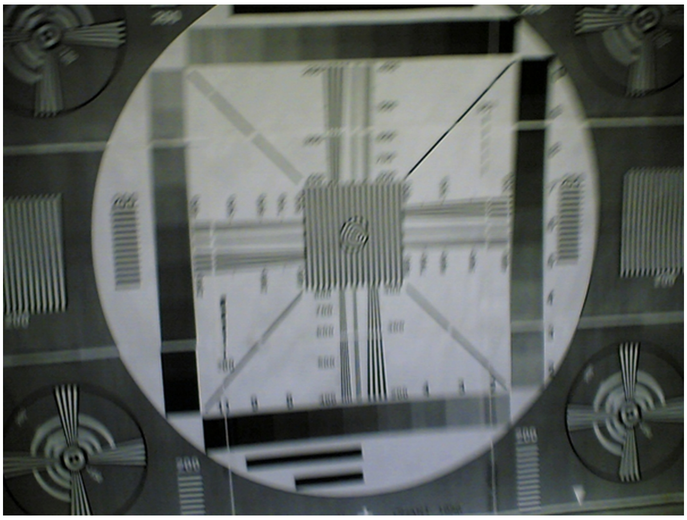


Figure 31 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and may happen when using the electronic shutter. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

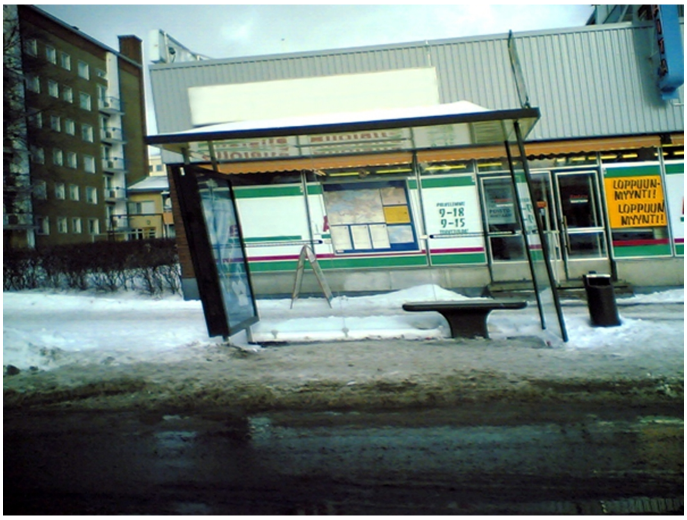


Figure 32 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. For example, in +70 degrees (Celsius), the noise level may be very high, and it further grows if the conditions are dim. If the phone processor has been heavily loaded for a long time before taking an image, the phone might have considerably higher temperature inside than in the surrounding environment. This is also normal to camera operation; do not change the camera module.

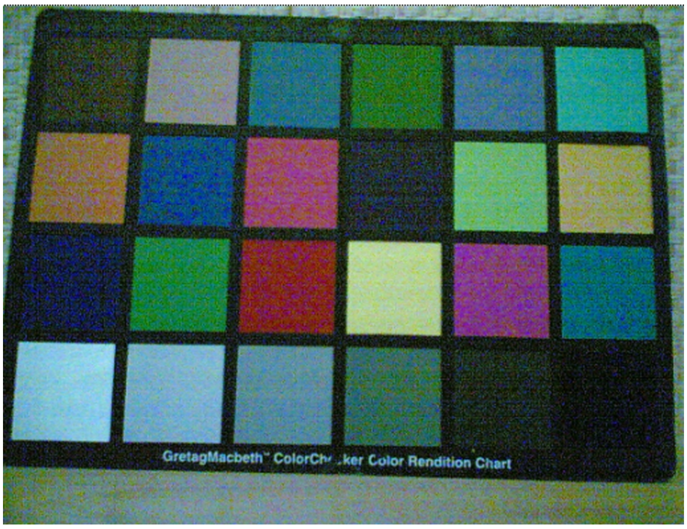


Figure 33 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

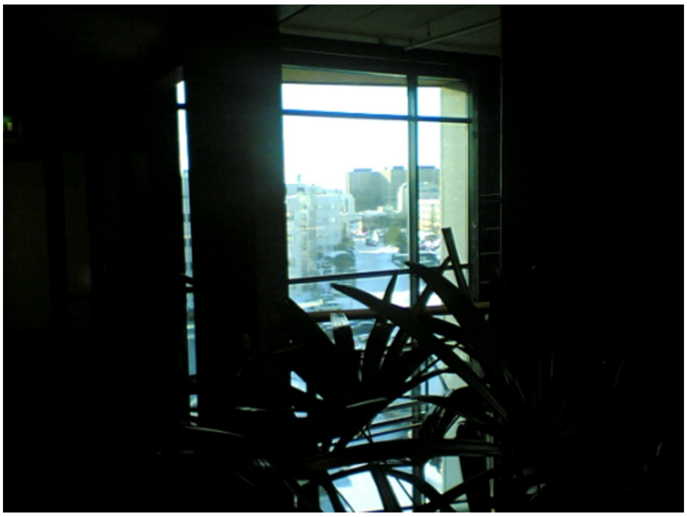


Figure 34 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. Flickering only occurs when the rolling shutter is used. This is normal behaviour; do not change the camera module.

Figure 35 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

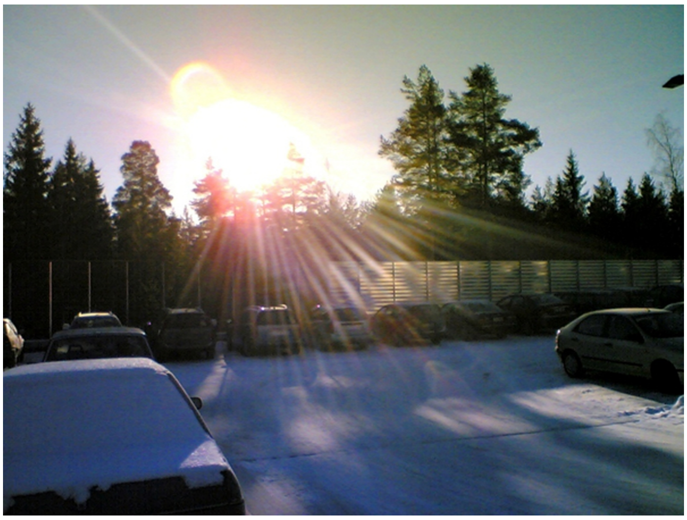


Figure 36 A lens reflection effect caused by sunshine

Examples of good quality images

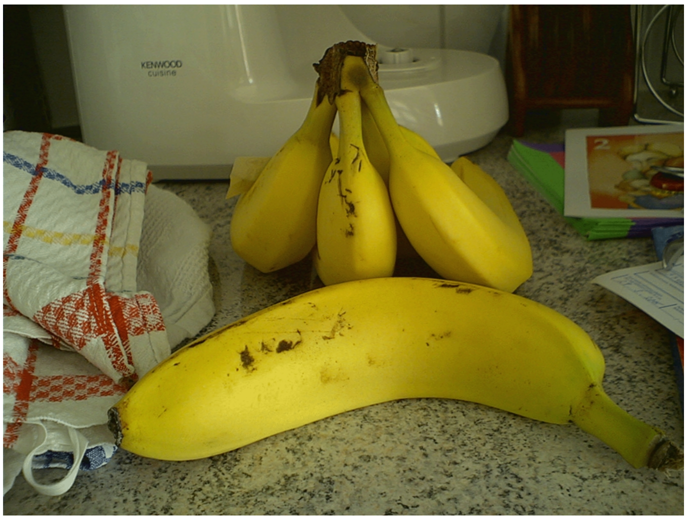


Figure 37 Good image taken indoors

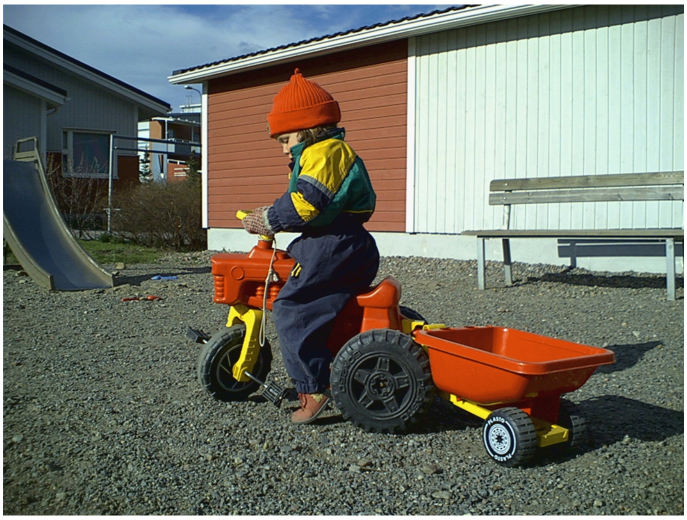


Figure 38 Good image taken outdoors

Image quality analysis

Possible faults in image quality

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

In addition, there are many other kinds of possibilities for bad image quality, but those are ruled out from the scope of this document since the probability of their appearance is small.

Testing for dust in camera module

Symptoms and diagnosis

For detecting these kinds of problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC monitor is preferred for analysis. Search carefully, since finding these defects is not always easy. Figure "Effects of dust on optical path" is an example image containing easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. One possibility is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering happens, try to reduce illumination level. Use JPEG image format for analysing, and set the image quality parameter to ‘High Quality’.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Thus it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If a dust particle is lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and thus the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

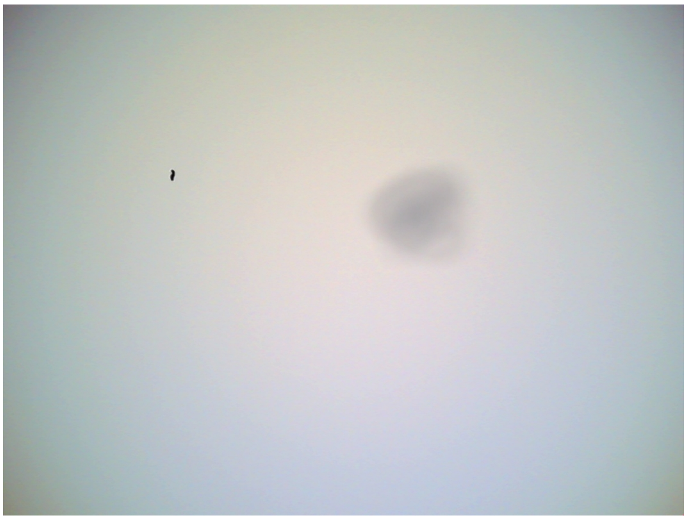


Figure 39 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between camera window and lens, they will cause image blurring and poor contrast. The dust gasket between the window and lens should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module and the camera should be replaced. Any particles inside the cavity between the protection window and lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Symptoms and diagnosis

If pictures taken with a device are claimed to be blurry, there are five possible sources for the problem:

1. The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.
2. The camera module has failed to focus correctly, producing a blurred image.
3. User has tried to take pictures in too dark conditions and images are blurred due to handshake or movement. This is not a cause to replace camera module.
4. There is dirt between the protection window and the camera lens.
5. The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene, such as the one in Figure "Good image taken indoors", can be used as a target. The main considerations are:

- The camera module has to be given time to focus correctly. Correct focusing is normally indicated with a flashing icon or green bracket in the viewfinder. During focusing, the image in the viewfinder moves slightly back and fourth, this is normal and shows that the lens unit is moving. During the movement a faint sound can be heard from the camera head.
- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

There are several conditions in which AF operation is challenging for the camera module, i.e. failing from time to time. These include:

- Low light scenes and night mode
- Scenes with low contrast
- Fast-moving objects

AF operation is disabled on purpose in “night”, “landscape”, “sports”, and “video” modes. When using these modes the lens is set to a predetermined focal position and isn’t moved during use.

Under low light and night mode the AF function is slower than under good light, it may even fail to find correct focus position. Low contrast scenes or fast moving objects may also slow down or cause AF to fail. This is normal operation, and is not a cause to replace camera.

The operation of AF can be tested by taking images of objects at different distances. Good distances are 20 cm, 60 cm and infinity (>3 m). Any LED or xenon flashes should not be used while taking the images.

The taken images should be analysed on PC screen at 100% scaling simultaneously with a reference image. Pay attention to the computer display settings; at least 65000 colors (16 bit) have to be used. 256 (8-bit) color setting is not sufficient; true color (24 bit, 16 million colors) or 32 bit (full color) setting is recommended.

If the differences are noticeable at a glance and also if the one under investigation is significantly inferior, the module might have a faulty lens. In this case, the module should be changed. Always recheck the resolution after changing the camera module. If a different module produces a clearly noticeable quality gap, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module. As references Figure "Good image taken indoors" and Figure "Good image taken outdoors" can be used. Another possibility is to use a service point comparison phone, if available.

Effects of dirty or defective camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

> **Note:** The effects of any dirt in images can vary very much; it may be difficult to judge if the window has been dirty when some image has been taken or if something else has been wrong. That is why the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

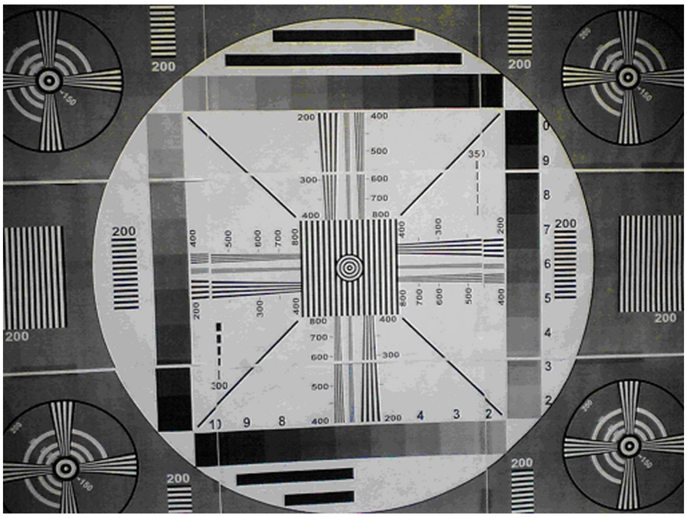


Figure 40 Image taken with clear protection window

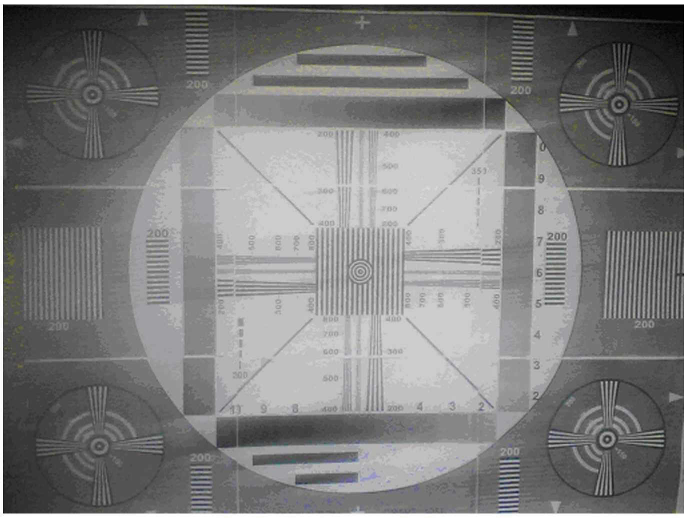


Figure 41 Image taken with greasy protection window

Bright point light sources might cause images that have flares around the light source if the protection window is dirty. A smeared fingerprint may be hard to see on the protective window but if will affect the image quality. These flares can be avoided by cleaning the window with a suitable cloth.

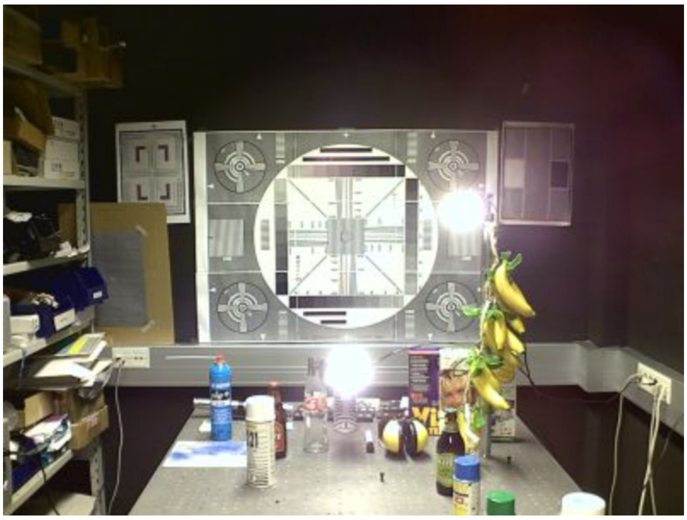


Figure 42 Image of point light sources taken with a clean protective window

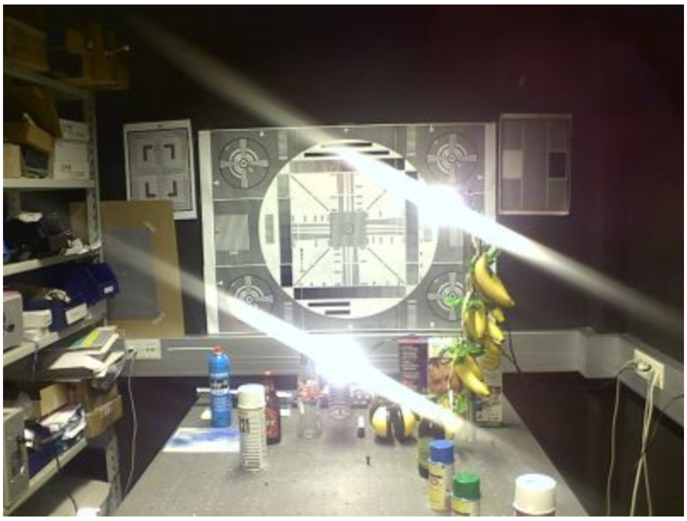


Figure 43 Image of point light sources taken with a dirty (finger print) protective window

Faulty pixels in images

Faulty pixels are pixels that do not respond to light in the same way as the pixels around them. There are three main types of faulty pixels, dead, stuck and hot pixels.

Dead pixels are always black or significantly darker than their surrounding. Dead pixels appear as black spots in all lightning conditions. Camera modules producing images with dead pixels that are clearly noticeable should be replaced.

If the pixel remains always saturated to its maximum value it is stuck. Stuck pixels may appear as red, green, blue or white spots in all lightning conditions. Camera modules producing images with one or more stuck pixels should be replaced.

Hot pixels are pixels that easily saturate in dim light conditions. It is normal to get a lot of noise and hot pixels in night conditions or otherwise dark conditions. The hot pixels should disappear when the ambient light is increased, but may still appear in darker areas of an otherwise well illuminated scene.

When examining an image for defect pixels, test images should be viewed as 100% enlargements on a PC monitor.

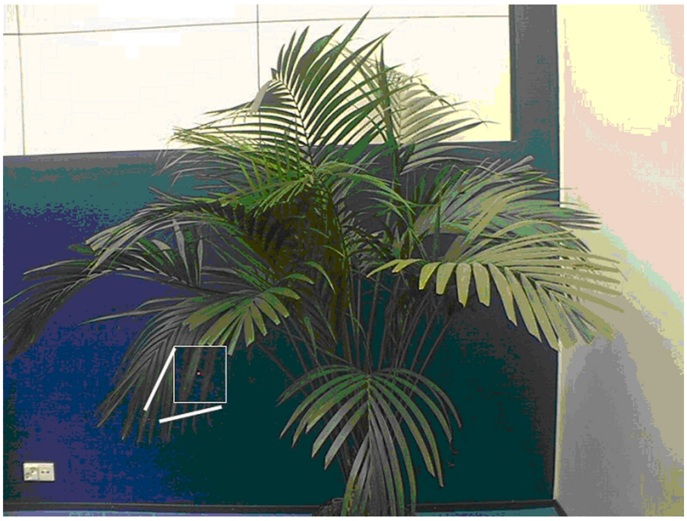


Figure 44 Enlargement of a hot pixel

Flash photography problems

Use of flash device may affect the image in many ways.

- White balance errors. The image may get a wrong tone due to mixing of flash colour temperature and ambient lightning. This is unwanted but normal feature.
- Dust reflections. Dust or water drops in front of the flash unit may reflect strongly to the camera sensor. See the following figure.

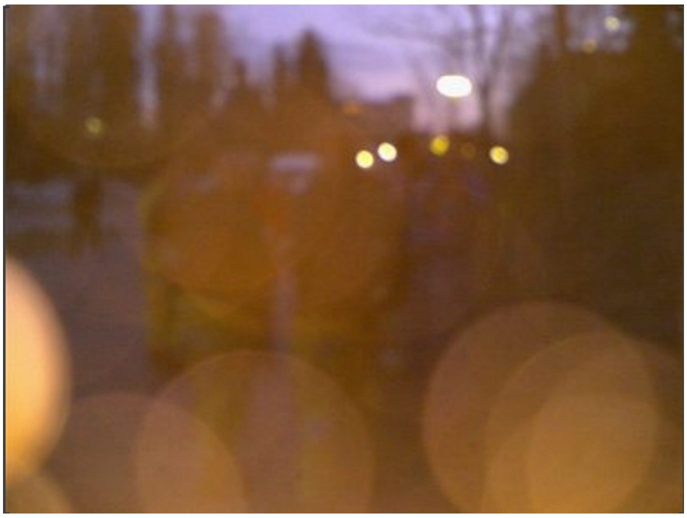
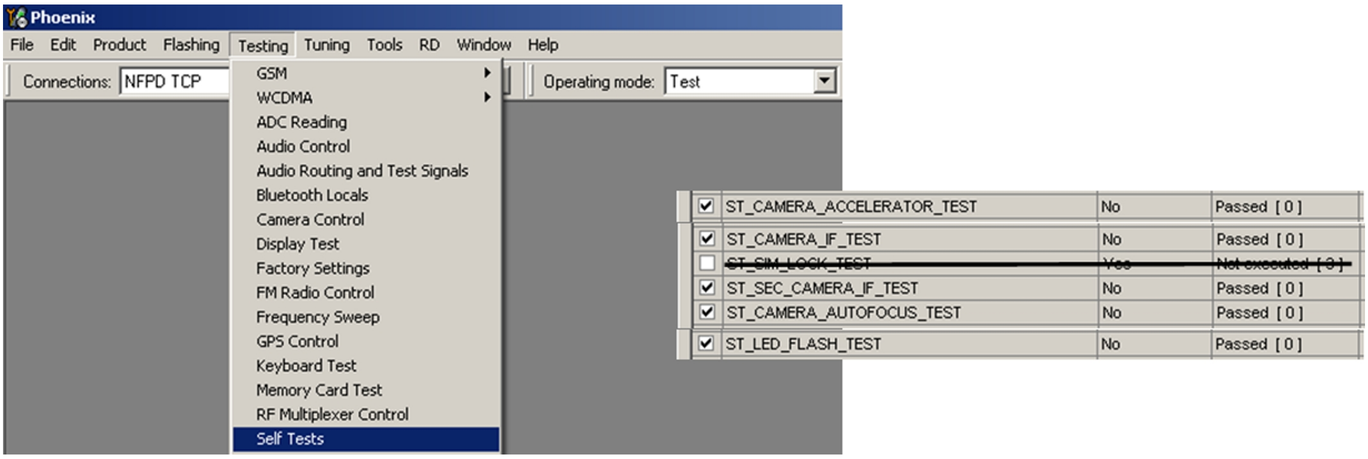


Figure 45 Light from the flash has reflected on particles in front of the camera

Main camera, secondary camera and flash troubleshooting

Main camera, secondary camera and flash troubleshooting

- Connect phone to the flash jig.
- In test mode run following self tests:


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Connections: NFPD TCP
Operating mode: Test
GSM
WCDMA
ADC Reading
Audio Control
Audio Routing and Test Signals
Bluetooth Locals
Camera Control
Display Test
Factory Settings
FM Radio Control
Frequency Sweep
GPS Control
Keyboard Test
Memory Card Test
RF Multiplexer Control
Self Tests

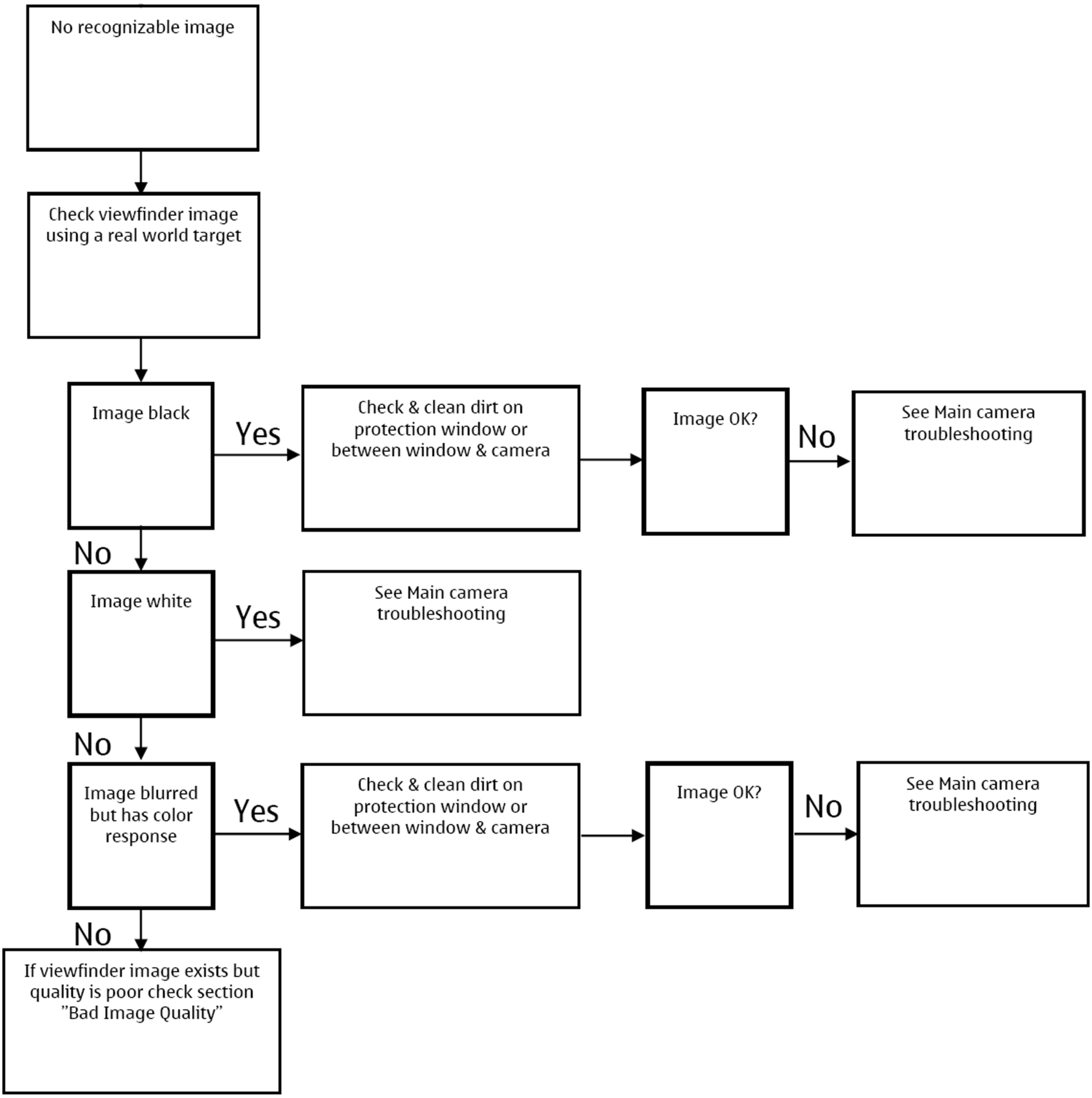
☑	ST_CAMERA_ACCELERATOR_TEST	No	Passed [0]
☑	ST_CAMERA_IF_TEST	No	Passed [0]
☐	~~ST_SIM_LOCK_TEST~~	~~Yes~~	~~Not executed [0]~~
☑	ST_SEC_CAMERA_IF_TEST	No	Passed [0]
☑	ST_CAMERA_AUTOFOCUS_TEST	No	Passed [0]
☑	ST_LED_FLASH_TEST	No	Passed [0]

- If main ST_CAMERA_IF_TEST or ST_CAMERA_AUTOFOCUS_TEST fails, check connector X1451 and change camera flex (2).
- If ST_SEC_CAMERA_IF_TEST fails, change UI flex and dynamic flex. Check also the flex connectors.
- If ST_LED_FLASH_TEST fails and flash led does not flash, change AV flex and check the connector X1451.

  Note: Note that dim white flash is seen during still imaging even when the flash is manually turned off. This is called an indicator and its normal behavior – do not change components.
- If ST_CAMERA_ACCELERATOR_TEST fails, remove camera flex (2), UI flex and AV flex and try this test again.
  - If the test is passed, connect the removed flexes one at a time and try the test again. Change the flex that causes the problem.
  - If the test will not pass, the camera engine is broken. These parts are under the can and thus can not be repaired.

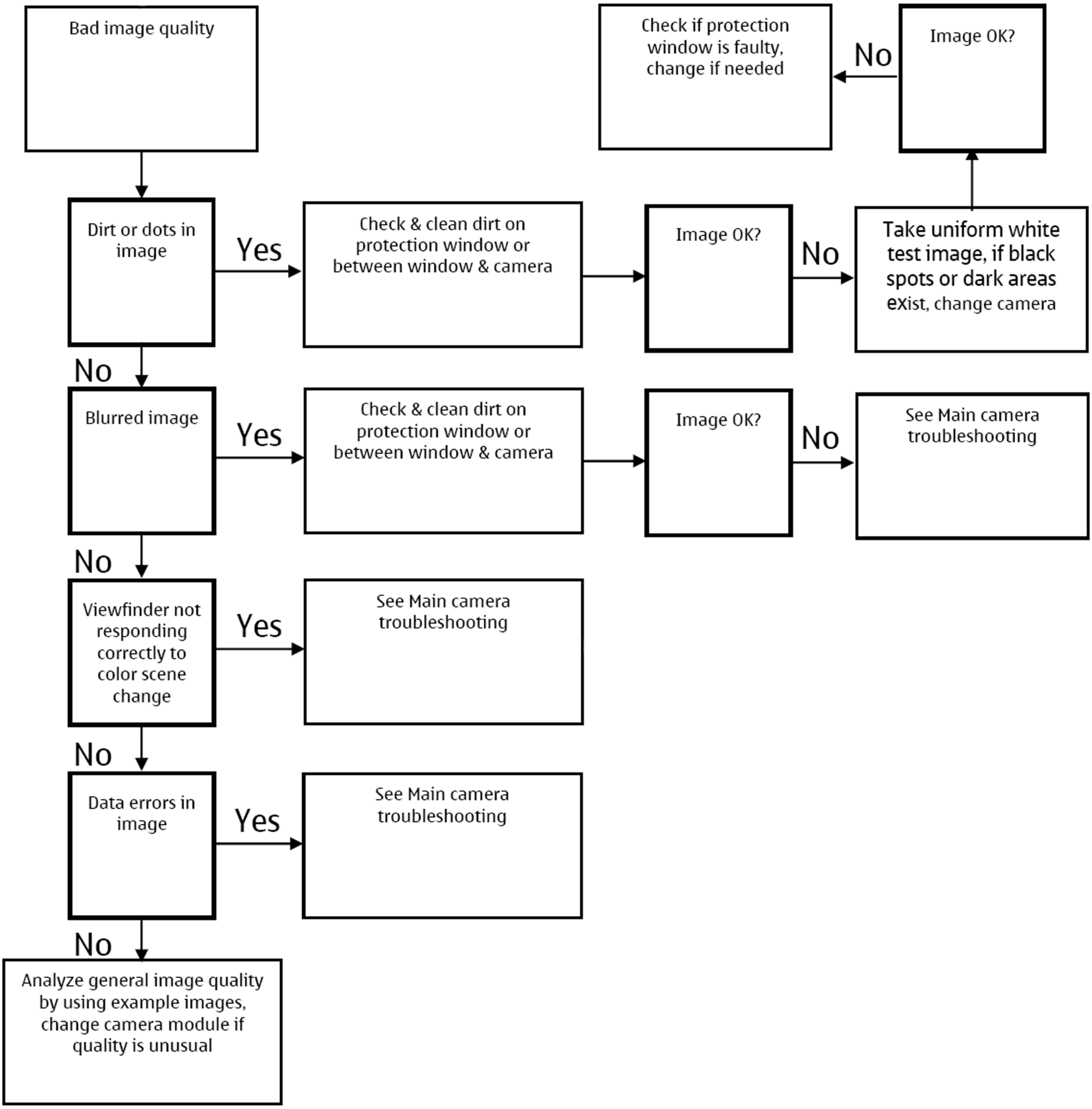
No recognizable viewfinder image

Troubleshooting flow


No recognizable image
Check viewfinder image using a real world target
Image black
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
See Main camera troubleshooting
No
Image white
Yes
See Main camera troubleshooting
No
Image blurred but has color response
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
See Main camera troubleshooting
No
If viewfinder image exists but quality is poor check section "Bad Image Quality"

Bad image quality troubleshooting

Troubleshooting flow


Bad image quality
Dirt or dots in image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
Take uniform white test image, if black spots or dark areas exist, change camera
Image OK?
No
Check if protection window is faulty, change if needed
No
Blurred image
Yes
Check & clean dirt on protection window or between window & camera
Image OK?
No
See Main camera troubleshooting
No
Viewfinder not responding correctly to color scene change
Yes
See Main camera troubleshooting
No
Data errors in image
Yes
See Main camera troubleshooting
No
Analyze general image quality by using example images, change camera module if quality is unusual

6 — System Module and User Interface

(This page left intentionally blank.)

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Introduction

Phone description

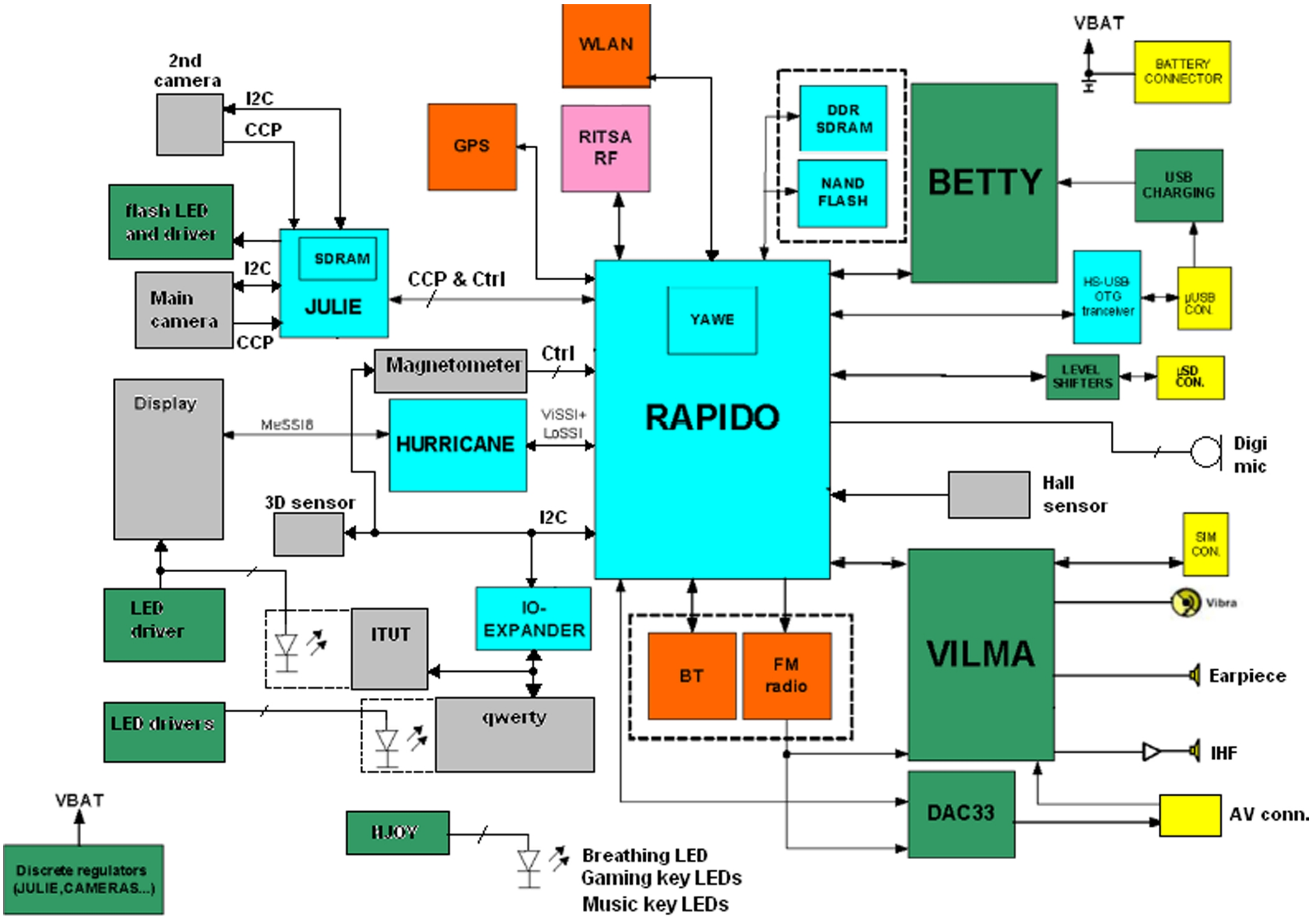
RAPIDOYAWE is the main digital baseband ASIC. It contains functionality for both WCDMA and GSM EDGE.

AVILMA is power management ASIC having voltage regulators and audio transceiver and BETTY is energy management ASIC having charging switch and FBUS transceiver.

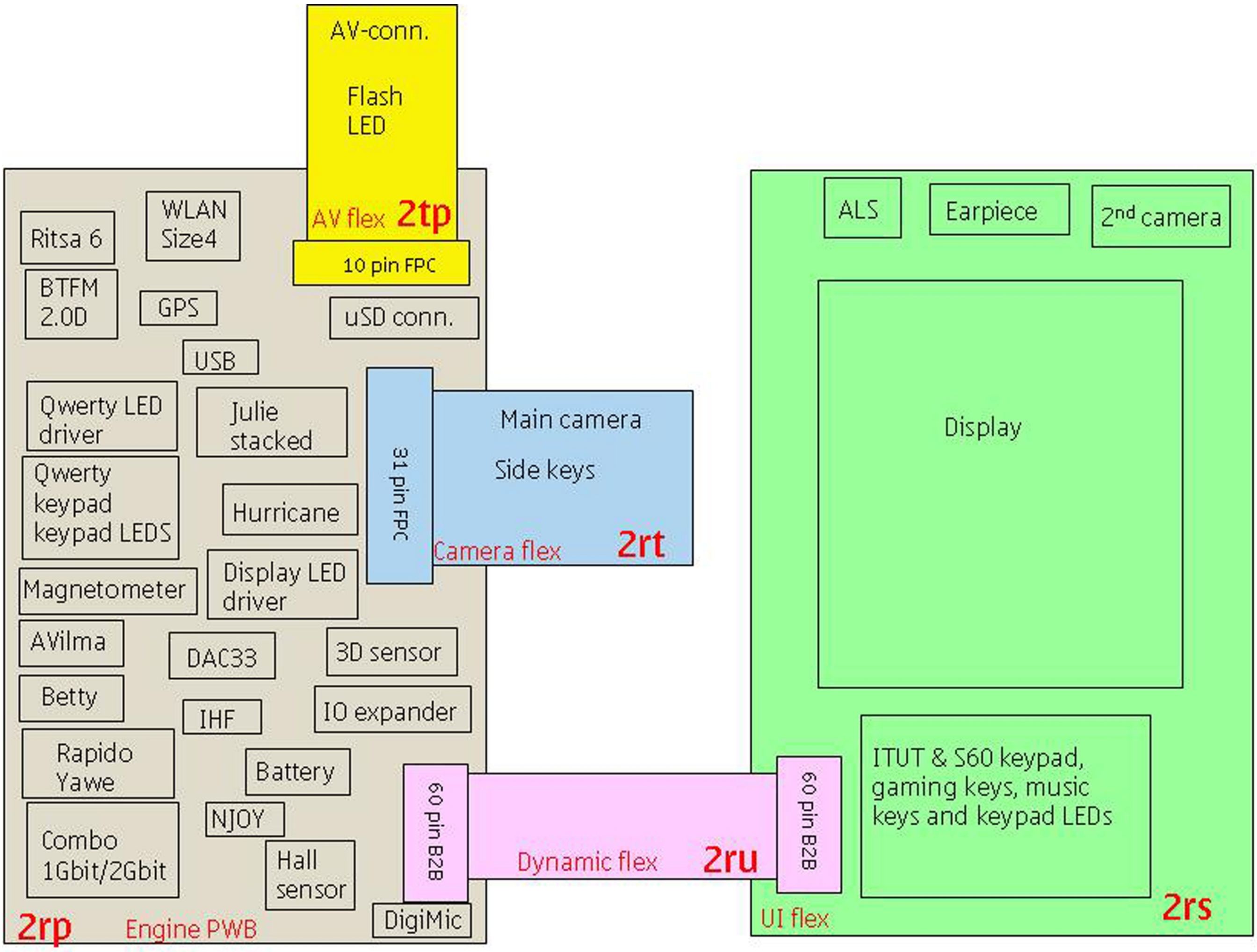
Memory components are internal COMBO 1 Gb/2 Gb and a card reader for MicroSD.

Function	Description	Item ref
EM ASIC	AVILMA	N2200
	BETTY	N2300
System ASIC	RAPIDOYAWE	D2800
Memory	Combo 1Gb DDR + 2Gb M3	D3000
Camera accelerator	OMAP-DM500	N1400
Display controller	S1D13747	D2450
Back-up battery	RTC BACKUP CAPAC 3225	G2200
FM radio with RDS	BTHFMRDS2.0D module	N6000
Bluetooth	BTHFMRDS2.0D module	N6000
WLAN	WLAN module ENW49701N	N6300
GPS	GPS5350_ROM3.0	N6200
RF ASIC	Vapaus	N7500
GSM PA	850/900/1800/1900	N7520
WCDMA PA	850/900/1900/2100	N7540
Oscillator	VCTCXO 38.4MHZ	G7500
	TCXO 38.4 MHz	G6450
	Crystal 32.768KHZ	B2200
IO-expander	BASIC IOExpander	N2850
SIM card reader		X2700
HS USB transceiver	ISP1707	D3300
Accelerometer	AHTI_A 3-AXIS	N6501

System module block diagram


WLAN
VBAT
BATTERY CONNECTOR
2nd camera
I2C
CCP
GPS
RITSA RF
DDR SDRAM
NAND FLASH
BETTY
USB CHARGING
flash LED and driver
SDRAM
JULIE
I2C
Main camera
CCP
CCP & Ctrl
YAWE
RAPIDO
HS-USB OTG tranceiver
μUSB CON.
LEVEL SHIFTERS
μSD CON.
Magnetometer
Ctrl
Display
MeSSI8
HURRICANE
ViSSI+ LoSSI
Digi mic
Hall sensor
3D sensor
I2C
SIM CON.
LED driver
IO-EXPANDER
ITUT
BT
FM radio
VILMA
Vibra
Earpiece
LED drivers
qwerty
IHF
VBAT
DAC33
AV conn.
HJOY
Discrete regulators (JULIE,CAMERAS...)
Breathing LED
Gaming key LEDs
Music key LEDs

Board and module connections


AV-conn.
Flash LED
AV flex
2tp
10 pin FPC
Ritsa 6
WLAN Size4
BTFM 2.0D
GPS
uSD conn.
USB
Qwerty LED driver
Julie stacked
Qwerty keypad keypad LEDS
Hurricane
Magnetometer
Display LED driver
AVilma
DAC33
3D sensor
Betty
IHF
IO expander
Rapido Yawe
Battery
Combo 1Gbit/2Gbit
NJOY
Hall sensor
DigiMic
2rp
Engine PWB
31 pin FPC
Main camera
Side keys
Camera flex
2rt
60 pin B2B
Dynamic flex
2ru
60 pin B2B
ALS
Earpiece
2nd camera
Display
ITUT & S60 keypad, gaming keys, music keys and keypad LEDs
UI flex
2rs

Energy management

Battery and charging

BL-4U battery

3.7V
BL-4U
NOKIA

The phone is powered by a 3-pole BL-4U battery S-pack 1000 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

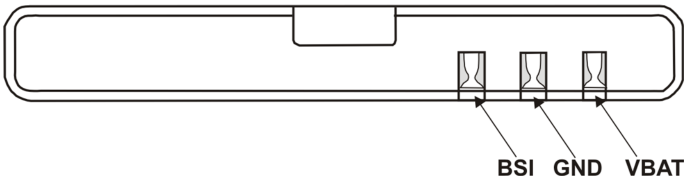


Figure 46 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

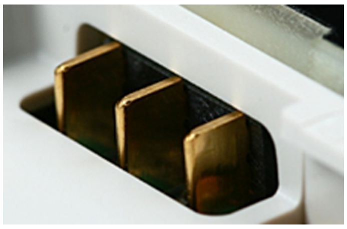


Figure 47 Blade battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

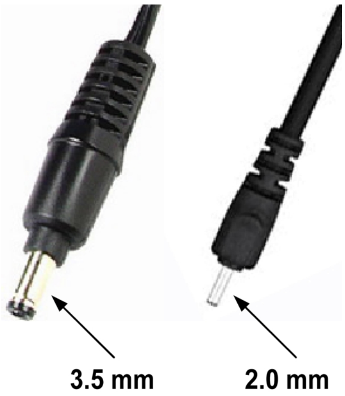


Figure 48 Small (right) and wide (left) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5K battery is used.

Table 6 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage	4.230	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on

Voltage	Voltage [V]	Condition
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.15	In call
Sw shutdown	3.3	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

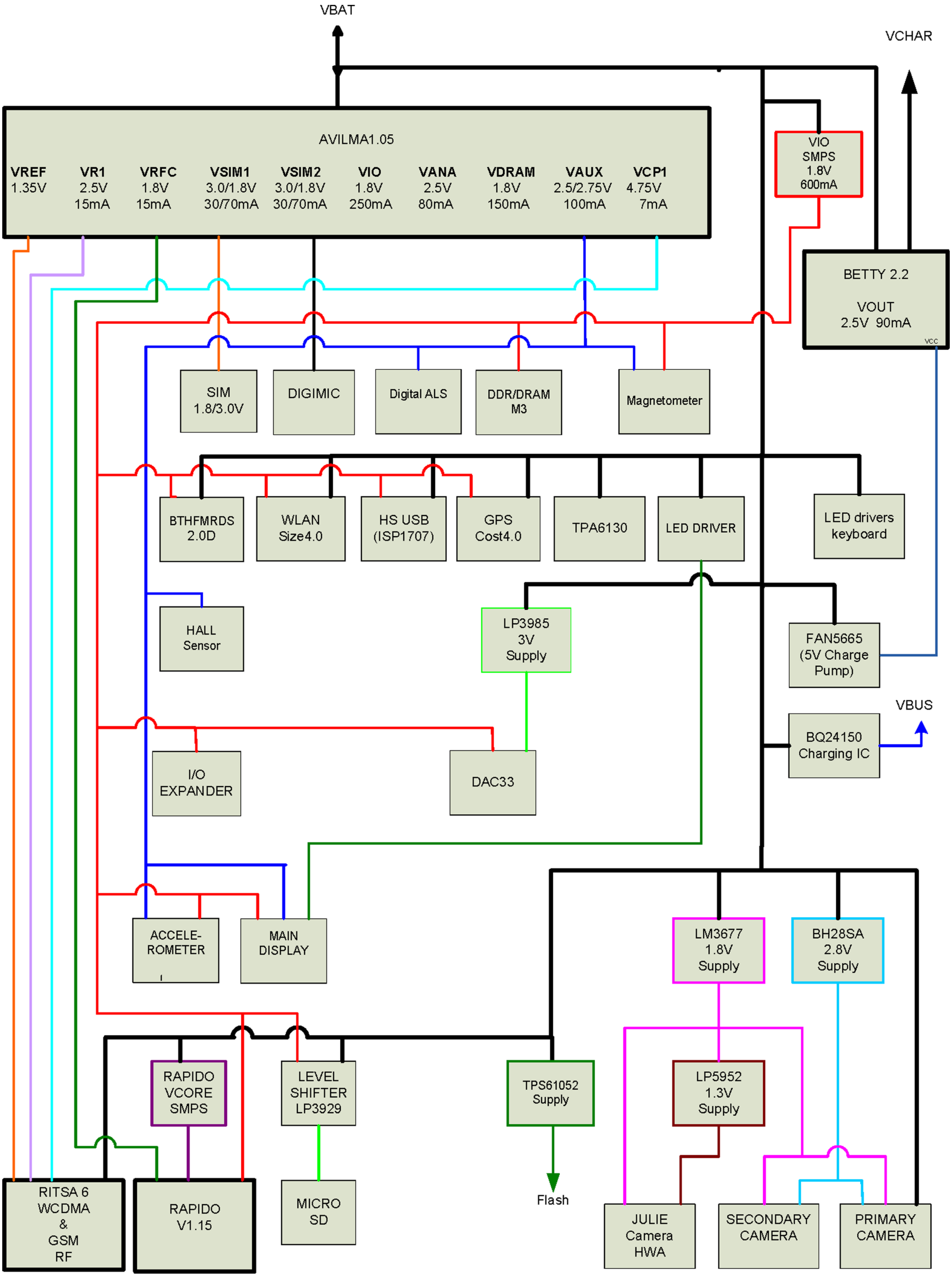
Power key and system power-up

Power key is in end key. When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

The power key may be disabled in certain charging cases.

Power distribution


VBAT
VCHAR
AVILMA1.05
VREF 1.35V
VR1 2.5V 15mA
VRFC 1.8V 15mA
VSIM1 3.0/1.8V 30/70mA
VSIM2 3.0/1.8V 30/70mA
VIO 1.8V 250mA
VANA 2.5V 80mA
VDRAM 1.8V 150mA
VAUX 2.5/2.75V 100mA
VCP1 4.75V 7mA
VIO SMPS 1.8V 600mA
BETTY 2.2
VOUT 2.5V 90mA
VCC
SIM 1.8/3.0V
DIGIMIC
Digital ALS
DDR/DRAM M3
Magnetometer
BTHFMRDS 2.0D
WLAN Size4.0
HS USB (ISP1707)
GPS Cost4.0
TPA6130
LED DRIVER
LED drivers keyboard
HALL Sensor
LP3985 3V Supply
FAN5665 (5V Charge Pump)
VBUS
BQ24150 Charging IC
I/O EXPANDER
DAC33
ACCELE-ROMETER
MAIN DISPLAY
LM3677 1.8V Supply
BH28SA 2.8V Supply
RAPIDO VCORE SMPS
LEVEL SHIFTER LP3929
TPS61052 Supply
LP5952 1.3V Supply
Flash
RITSA 6 WCDMA & GSM RF
RAPIDO V1.15
MICRO SD
JULIE Camera HWA
SECONDARY CAMERA
PRIMARY CAMERA

Clocking scheme

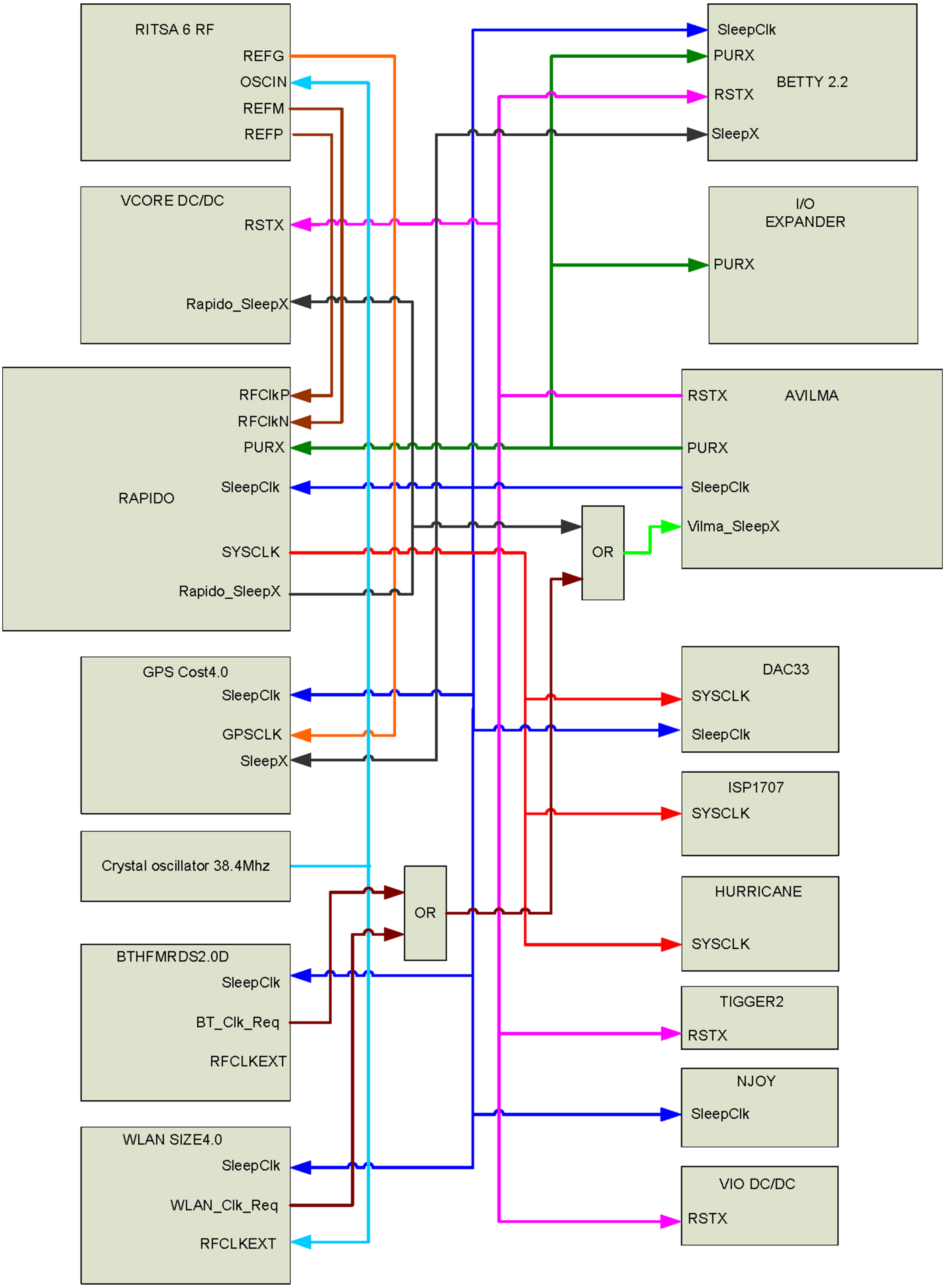

RITSA 6 RF
REFG
OSCIN
REFM
REFP
VCORE DC/DC
RSTX
Rapido_SleepX
RAPIDO
RFClkP
RFClkN
PURX
SleepClk
SYSCLK
Rapido_SleepX
GPS Cost4.0
SleepClk
GPSCLK
SleepX
Crystal oscillator 38.4Mhz
BTHFMRDS2.0D
SleepClk
BT_Clk_Req
RFCLKEXT
WLAN SIZE4.0
SleepClk
WLAN_Clk_Req
RFCLKEXT
OR
OR
BETTY 2.2
SleepClk
PURX
RSTX
SleepX
I/O
EXPANDER
PURX
AVILMA
RSTX
PURX
SleepClk
Vilma_SleepX
DAC33
SYSCLK
SleepClk
ISP1707
SYSCLK
HURRICANE
SYSCLK
TIGGER2
RSTX
NJOY
SleepClk
VIO DC/DC
RSTX

Figure 49 Clocking scheme

Bluetooth and FM RDS radio module

Bluetooth and FM radio receiver are provided by the same ASIC (Broadcom BCM2048). The device supports Bluetooth operation and FM radio rececption in both European/USA and Japanese bands (the appropriate region-specific FM radio band is pre-configured in the phone software). The UART interface allows the device to communicate with the phone baseband engine using Bluetooth HCI commands. Commands to the FM radio can also be sent over the I2C interface.

When Bluetooth is switched on, the phone user interface the BT_RESETX line is toggled to reset the Bluetooth device, and commands are sent over the UART interface to configure the device. If UART communication fails (due to a hardware fault) it will not be possible to switch on Bluetooth from the phone user interface.

The device has two clock signals: SYS_CLK (38.4MHz) and SLEEP_CLK (32.768kHz). The SLEEP_CLK is supplied all the time the phone is switched on. To maximise the phone standby time, it is only necessary to provide a SYS_CLK signal when Bluetooth activity occurs, such as sending Bluetooth data to another device, or checking periodically if there are any other Bluetooth devices attempting to communicate with it. At other times when the Bluetooth device is in standby mode or the FM radio is switched on it is only necessary to provide a SLEEP_CLK signal. The Bluetooth-FM ASIC is powered directly from the phone battery voltage line (VBAT). An internal regulator is enabled when Bluetooth or FM radio is switched on.

Bluetooth audio signals are sent to and from the device using a PCM interface. The Bluetooth RF signal is routed from Bluetooth module via a buried track and via an RF switch on WLAN module through the diplexer to the Bluetooth antenna on the top side of the PWB. The BPF filter is needed to prevent interference to and from the celluar phone antenna and it is located inside of the WLAN module. Bluetooth and WLAN and GPS use a shared antenna, as both services occupy the 2.4GHz ISM frequency band and GPS the 1.575GHz band. The co-existence signaling interface between Bluetooth and WLAN ASICs controls the RF activity in the shared frequency band.

The audio signal from the FM radio is routed via the phone Audio ASIC to the phone headset or loudspeaker. The external wired headset is also used as an Antenna for the FM radio. The FM radio receiver RF signal is routed from the ASIC via a buried track to an impedance matching circuit placed near the headset AV connector.

The following block diagram shows how Bluetooth-FM is connected to the host engine.

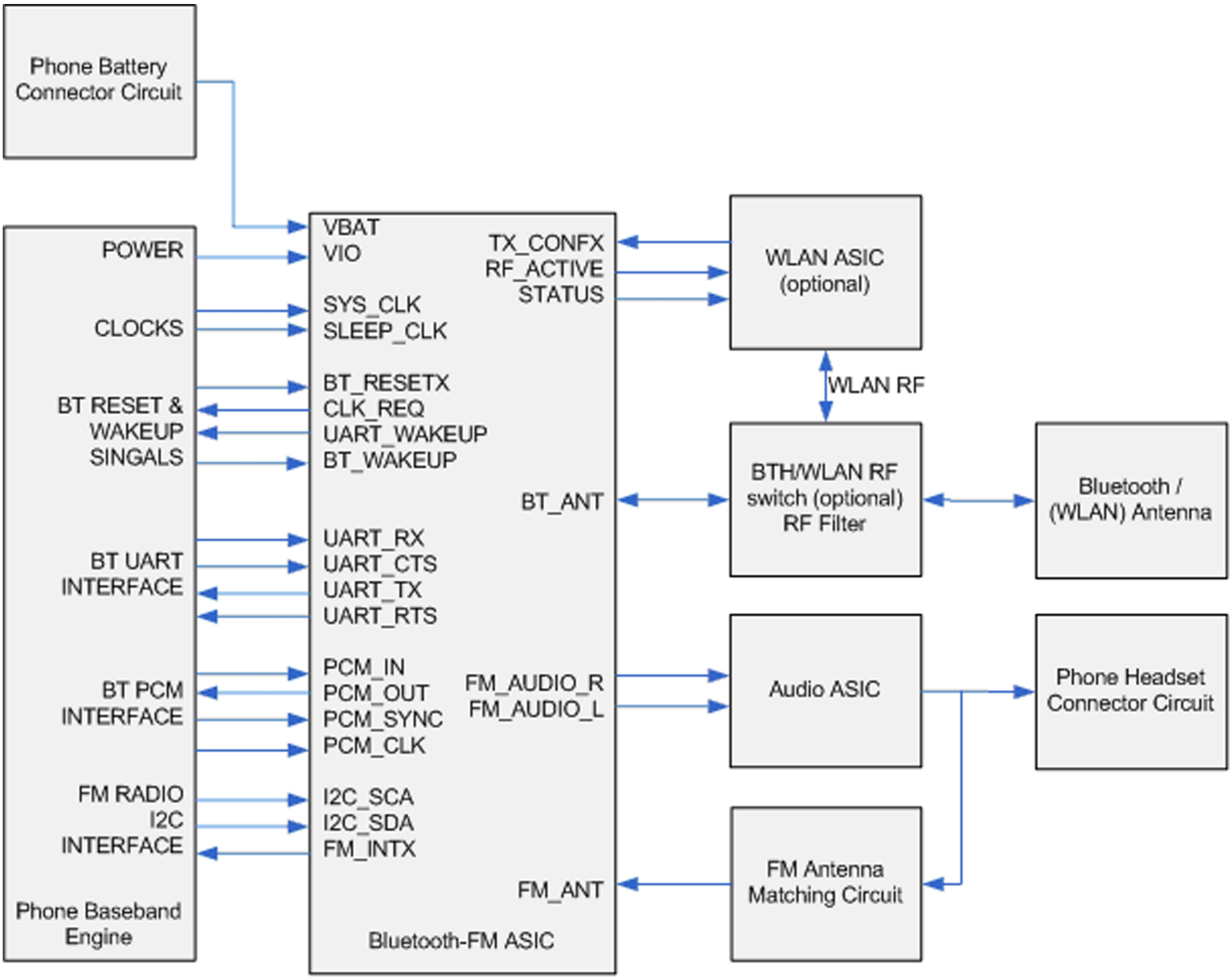

Phone Battery Connector Circuit
POWER
CLOCKS
BT RESET & WAKEUP SINGALS
BT UART INTERFACE
BT PCM INTERFACE
FM RADIO I2C INTERFACE
Phone Baseband Engine
VBAT
VIO
SYS_CLK
SLEEP_CLK
BT_RESETX
CLK_REQ
UART_WAKEUP
BT_WAKEUP
UART_RX
UART_CTS
UART_TX
UART_RTS
PCM_IN
PCM_OUT
PCM_SYNC
PCM_CLK
I2C_SCA
I2C_SDA
FM_INTX
TX_CONFX
RF_ACTIVE
STATUS
BT_ANT
FM_AUDIO_R
FM_AUDIO_L
FM_ANT
Bluetooth-FM ASIC
WLAN ASIC (optional)
WLAN RF
BTH/WLAN RF switch (optional) RF Filter
Bluetooth / (WLAN) Antenna
Audio ASIC
Phone Headset Connector Circuit
FM Antenna Matching Circuit

Figure 50 Bluetooth & FM radio block diagram

GPS module

The device supports GPSCost4.0 release. GPS module is connected to cellular engine via I2C interface and GenIO control signals. GPS clock configuration includes dedicated GPS TCXO and reference clock from Ahneus.

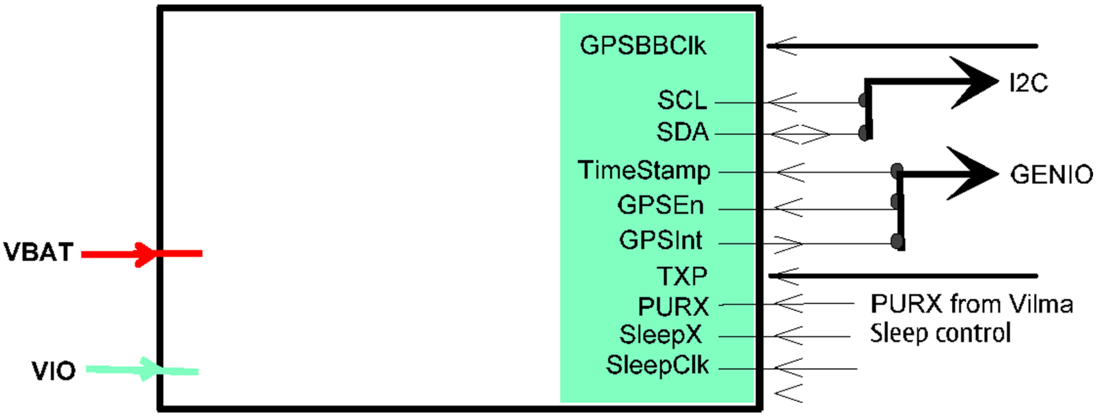

GPSBBClk
SCL
SDA
TimeStamp
GPSEn
GPSInt
TXP
PURX
SleepX
SleepClk
I2C
GENIO
PURX from Vilma
Sleep control
VBAT
VIO

Figure 51 GPS module

WLAN module

WLAN module supports WLANSize4.0 release. WLAN module is configured as Cellular engine SPI slave. WLAN and Bluetooth co-existence is supported via BTH-WLAN interface. WLANSize4.0 has a reference clock of external oscillator 38.4MHz and it is shared with BTHFMRDS2.0D.

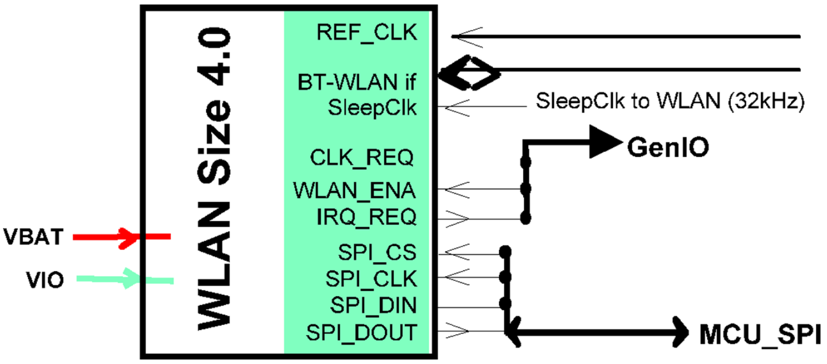
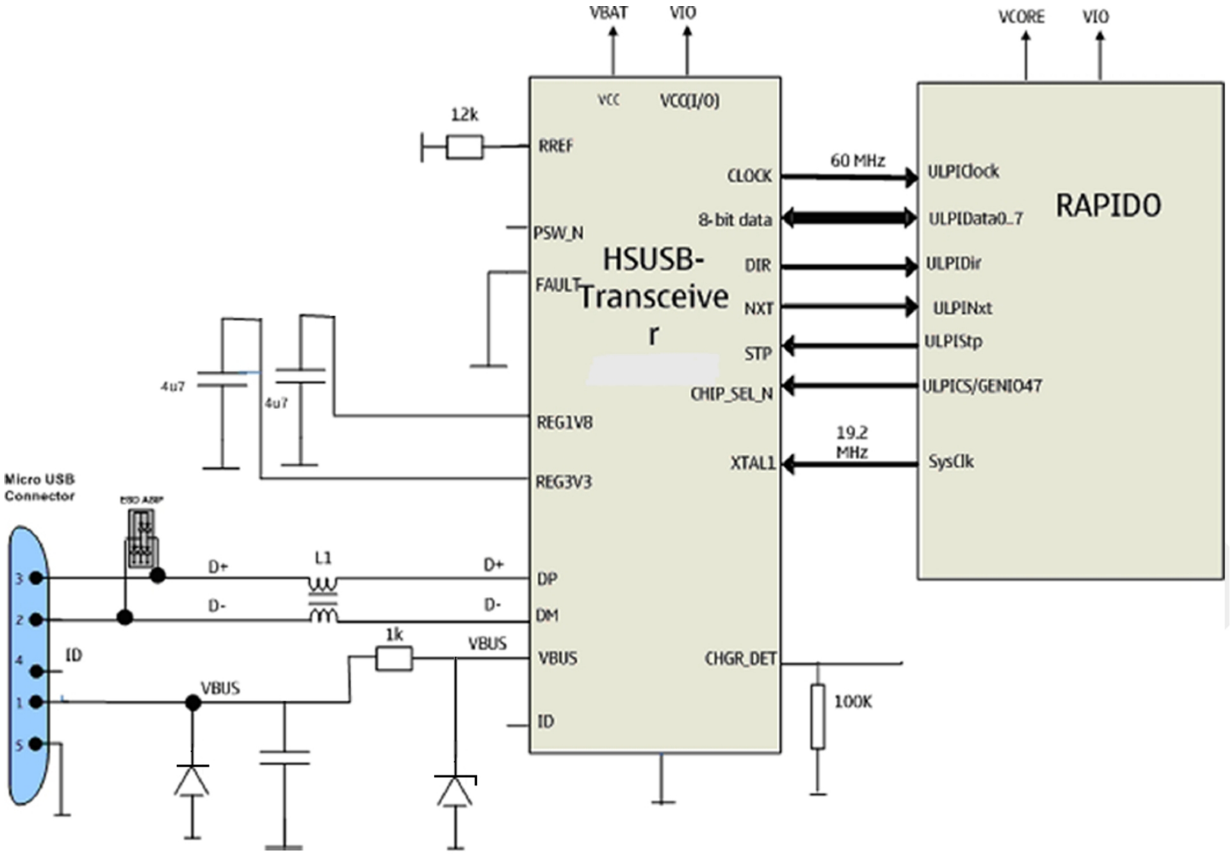

WLAN Size 4.0
REF_CLK
BT-WLAN if
SleepClk
SleepClk to WLAN (32kHz)
CLK_REQ
GenIO
WLAN_ENA
IRQ_REQ
VBAT
VIO
SPI_CS
SPI_CLK
SPI_DIN
SPI_DOUT
MCU_SPI

Figure 52 WLAN module

High-speed USB

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s). The external interface is the micro-B connector X3300. The interface between D3300 USB transceiver and micro-B receptacle is the standard USB interface specified in the Universal Serial Bus specification Rev. 2.0. The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND. Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device. The circuit is protected from an overvoltage condition by N3303 and V3300.


VBAT
VIO
VCORE
VIO
VCC
VCC(I/O)
12k
RREF
PSW_N
FAULT
HSUSB-Transceiver
CLOCK
8-bit data
DIR
NXT
STP
CHIP_SEL_N
XTAL1
REG1V8
REG3V3
60 MHz
19.2 MHz
ULPIClock
ULPIData0..7
ULPIDir
ULPINxt
ULPIStp
ULPICS/GENIO47
SysClk
RAPIDO
4u7
4u7
Micro USB Connector
ESD ASIP
3
2
4
1
5
ID
D+
D-
L1
D+
D-
1k
VBUS
VBUS
DP
DM
VBUS
ID
CHGR_DET
100K

CBUS interface

CBUS is a main system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW53 CBUS clock frequency is 4.39 MHz.

FBUS interface

FBUS is a 2-wire serial communication bus between HW53 engine and service SW.

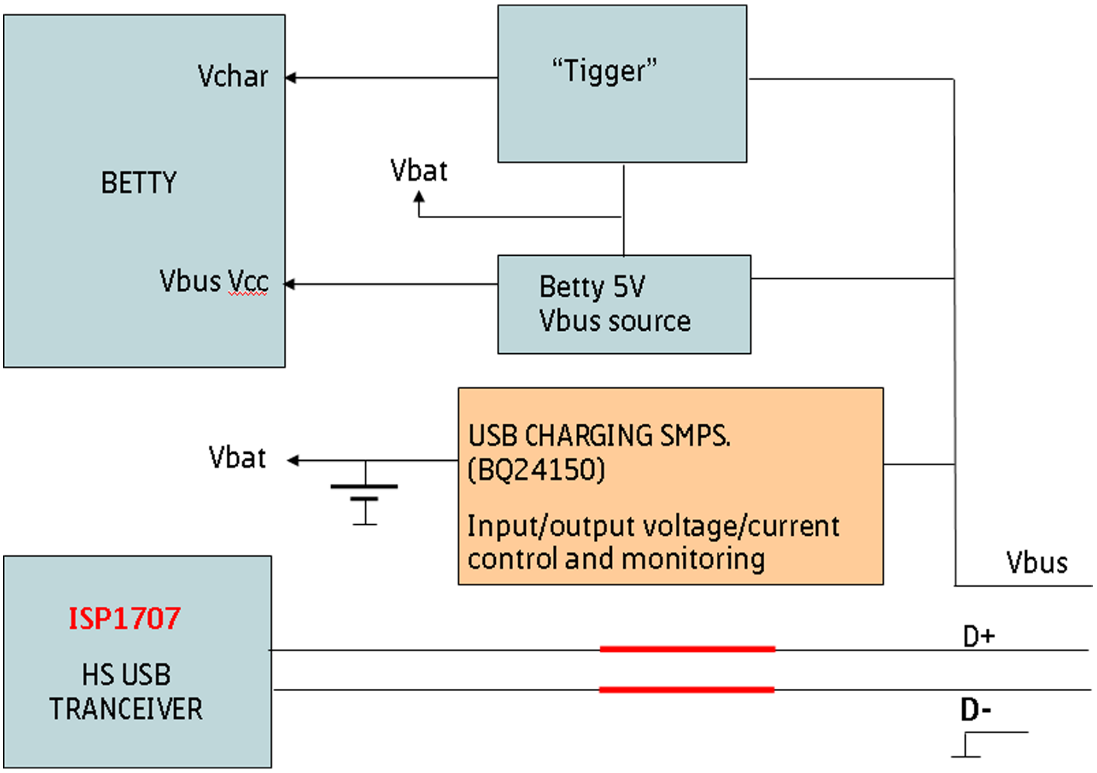
ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

USB charger interface

The main battery can be charged from the USB port. Default charging current level is 80 – 100 mA during the initial charging. Primary charging current level is up to 500 mA from USB Host and up to 1.25A from USB wall charger with external switch-mode USB Charger BQ24150.


Vchar
BETTY
Vbus Vcc
"Tigger"
Vbat
Betty 5V
Vbus source
Vbat
USB CHARGING SMPS.
(BQ24150)
Input/output voltage/current
control and monitoring
Vbus
ISP1707
HS USB
TRANCEIVER
D+
D-

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

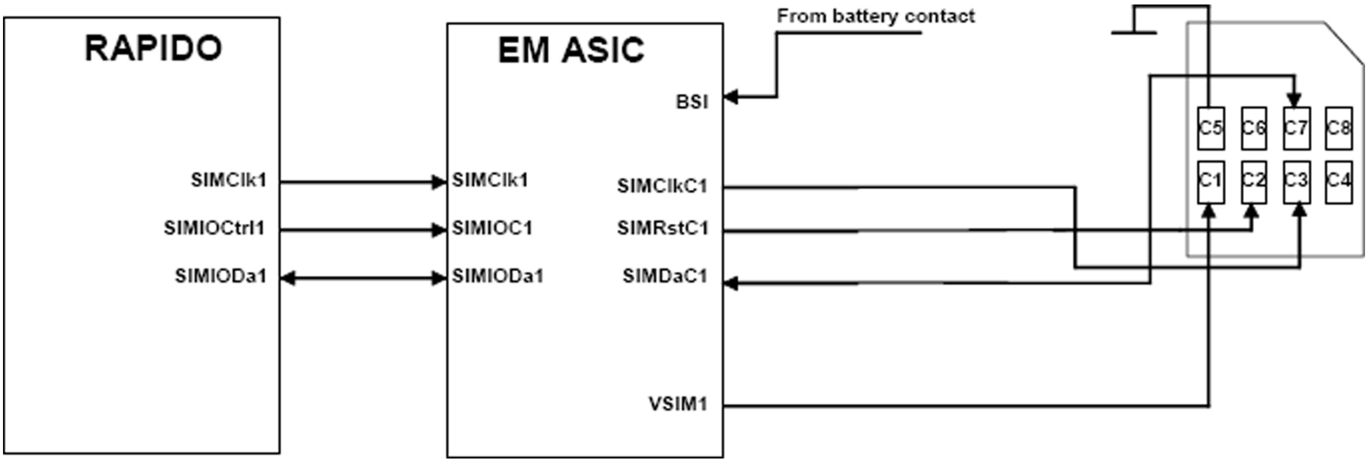

RAPIDO
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
C5
C6
C7
C8
C1
C2
C3
C4

Figure 53 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

MicroSD card interface

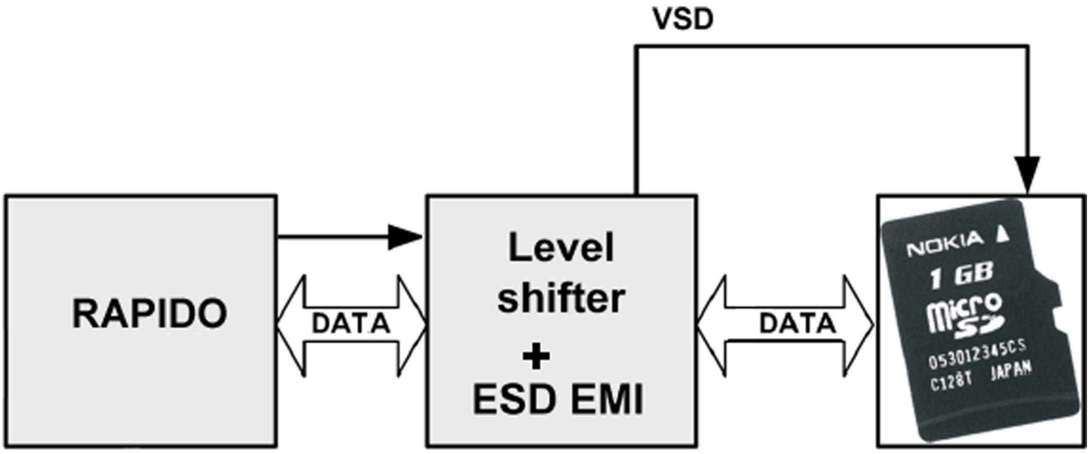

VSD
RAPIDO
DATA
Level shifter + ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

Figure 54 MicroSD card interface

The MicroSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

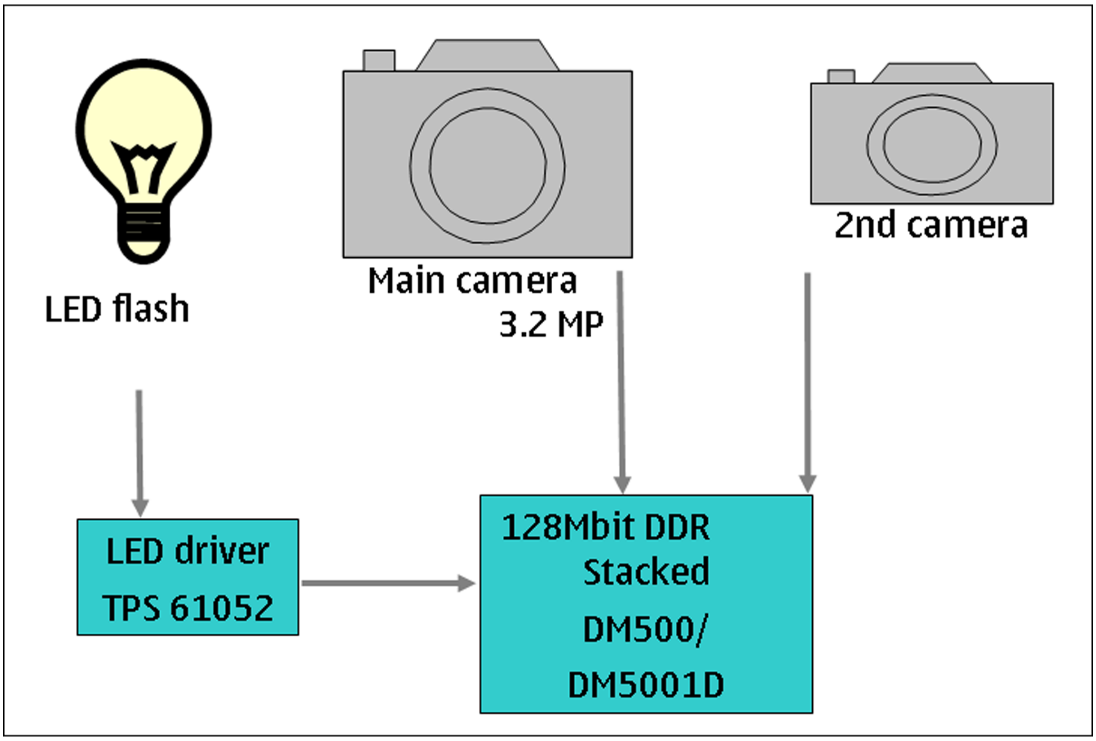
- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from VIO SMPS)

Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Camera concept

Camera concept

The camera system is supported by DM500/DM5001D (N1400) camera accelerator, which is used for image and video processing. DM500/DM5001D is DM299 stacked with 128MBit DDR-SDRAM. The camera system includes 3.2MPix main camera, VGA secondary camera, flash LED and TPS61052 LED driver which are connected to DM500/DM5001D.


LED flash
Main camera
3.2 MP
2nd camera
LED driver
TPS 61052
128Mbit DDR
Stacked
DM500/
DM5001D

User interface

User interface

The UI contains the following main features:

- Qwerty and ITU-T keyboards
- Joystick
- Microphone
- Earpiece
- IHF speaker
- LEDs
- Display
- Main camera and secondary camera

A block diagram of the UI is shown below. For clarity, the filtering components are not shown.

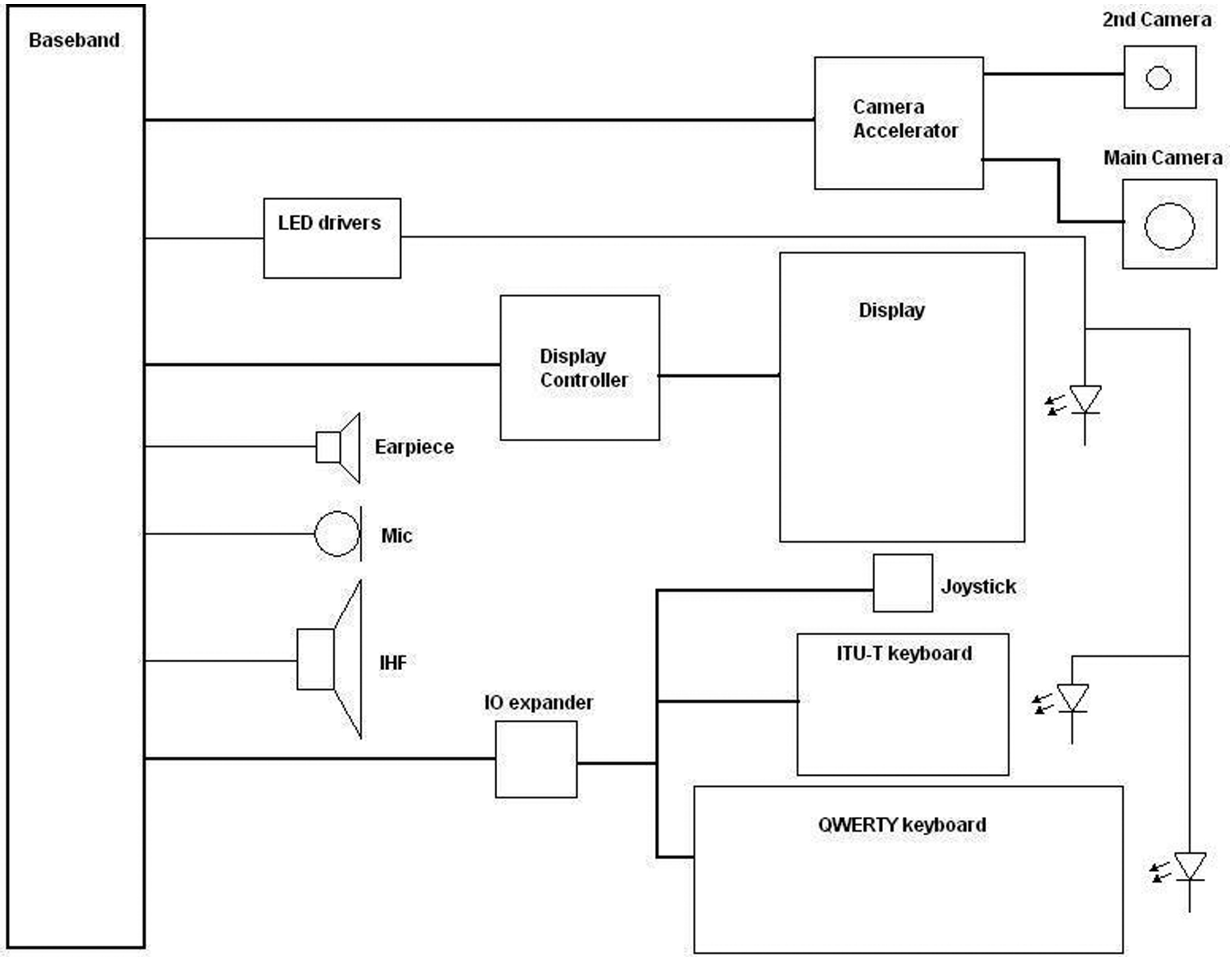

Baseband
2nd Camera
Camera Accelerator
Main Camera
LED drivers
Display
Display Controller
Earpiece
Mic
Joystick
IHF
ITU-T keyboard
IO expander
QWERTY keyboard

Figure 55 User interface block diagram

Display module

Display features

The device has a QVGA 2.4” display with 16M colours.

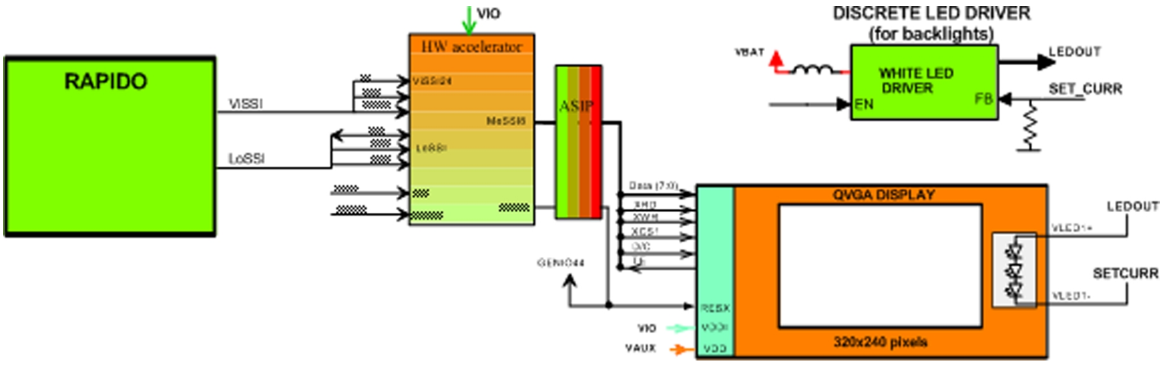
The module is a color active matrix LCD with a resolution of 240x320. It is a transflective display with a backlight unit using white LEDs and a lightguide surrounded by a white plastic frame.

As Brixton is LCD AM transflectived display, led driver based backlighting is needed.

Display interface

Figure *Display interface block diagram* below shows how the display related signals are routed. Display HWA controlling is done via LoSSI bus and pixel data is transferred via ViSSI-12 bus. MeSSI-8 is the interface between display HWA and display.

Supply voltages for display:

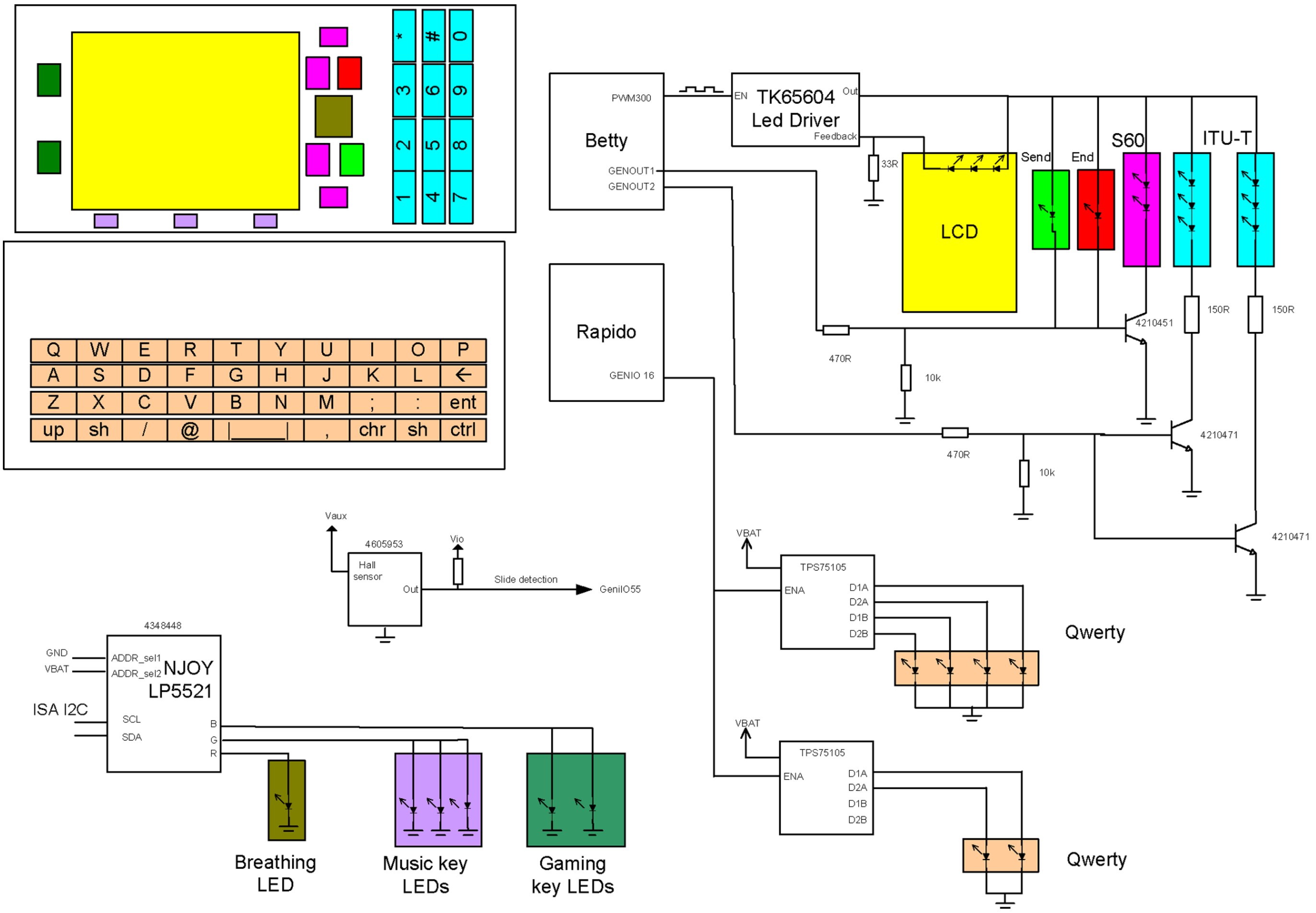

VIO
HW accelerator
RAPIDO
VSSI
LoSSI
ViSSI24
MeSSI8
LoSSI
ASIP
DISCRETE LED DRIVER
(for backlights)
VBAT
WHITE LED
DRIVER
EN
FB
LEDOUT
SET_CURR
Data (7:0)
SHD
XWR
XCS
D/C
TE
GENIO44
QVGA DISPLAY
320x240 pixels
RESX
VDDI
VDD
VIO
VAUX
LEDOUT
VLED1+
SETCURR
VLED1-

Keyboard

ITU keypad and five-way cursor control and dedicated multimedia key are implemented on a standard crosspoint matrix.

Backlight and illumination

The device has backlight illuminating the display, upper keypad, lower keypad and qwerty keypad.


* # 0
3 6 9
2 5 8
1 4 7
Q W E R T Y U I O P
A S D F G H J K L ←
Z X C V B N M ; : ent
up sh / @ |____| , chr sh ctrl
PWM300
Betty
GENOUT1
GENOUT2
EN
TK65604
Led Driver
Out
Feedback
33R
LCD
Send
End
S60
ITU-T
4210451
150R
150R
470R
10k
470R
10k
4210471
4210471
Rapido
GENIO 16
Vaux
4605953
Hall sensor
Out
Vio
Slide detection
GenIO55
VBAT
TPS75105
ENA
D1A
D2A
D1B
D2B
Qwerty
VBAT
TPS75105
ENA
D1A
D2A
D1B
D2B
Qwerty
4348448
GND
VBAT
ADDR_sel1
ADDR_sel2
NJOY
LP5521
ISA I2C
SCL
SDA
B
G
R
Breathing LED
Music key LEDs
Gaming key LEDs

■ ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC BETTY N2300

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED control for display backlighting
- Digital interface (CBUS)

EM ASIC VILMA N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

■ Device memories

Combo memory

The memory of the device consists of stacked DDR SDRAM and MuxedMassMemory (M3). Combo memory DDR/M3 memory has 768Mb DDR + 2Gb M3.

■ Audio concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter DAC33.

DAC33 converts digital audio signal to analog and is routed to the FM Transmitter and amplifier TPA6130 which provides an interface for the transducers and the accessory connector.

AVilma provides analog signal for earpiece and handsfree speaker.

There are three audio transducers:

- 5 x 11 mm dynamic earpiece
- 11 x 15 mm dynamic speaker
- Digital MEMS (microelectromechanical systems) microphone

Avilma provides an output for the dynamic vibra component. All wired audio accessories are connected to the AV accessory connector. A Bluetooth audio and FM radio module, which is connected to RAPIDOYAWE, supports Bluetooth audio and FM radio functionality.

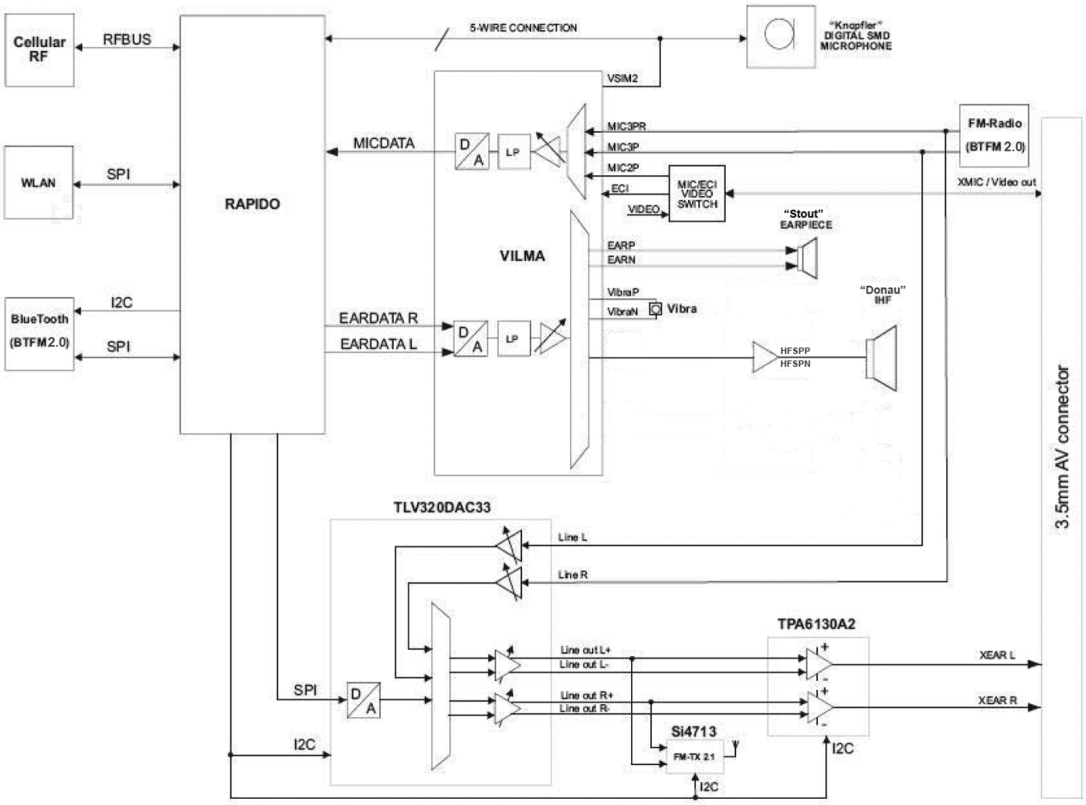

Cellular RF
RFBUS
WLAN
SPI
RAPIDO
BlueTooth (BTFM2.0)
I2C
SPI
5-WIRE CONNECTION
"Knopfler" DIGITAL SMD MICROPHONE
VSIM2
MICDATA
D A
LP
MIC3PR
MIC3P
MIC2P
ECI
VIDEO
MIC/ECI VIDEO SWITCH
FM-Radio (BTFM 2.0)
XMIC / Video out
"Stout" EARPIECE
VILMA
EARP
EARN
VibraP
VibraN
Vibra
"Donau" IHF
EARDATA R
EARDATA L
HFSPP
HFSPN
3.5mm AV connector
TLV320DAC33
Line L
Line R
TPA6130A2
Line out L+
Line out L-
Line out R+
Line out R-
XEAR L
XEAR R
SPI
I2C
Si4713
FM-TX 2.1
I2C
I2C

Figure 56 Audio system block

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. A digital MEMS microphone data and clock line are connected to Rapidoyawe and operating voltage is received from Avilma.

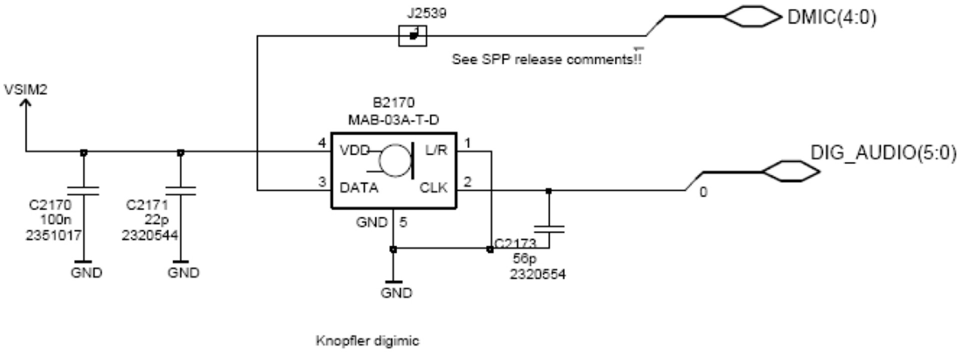

J2539
DMIC(4:0)
See SPP release comments!!
VSIM2
B2170
MAB-03A-T-D
VDD
L/R
DATA
CLK
GND
4
1
3
2
5
DIG_AUDIO(5:0)
0
C2170
100n
2351017
C2171
22p
2320544
GND
GND
GND
C2173
56p
2320554
Knopfler digimic

Figure 57 Internal microphone

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 8x12 mm earpiece capsule is Connected to Avilma ASIC's differential output EarP and EarN.

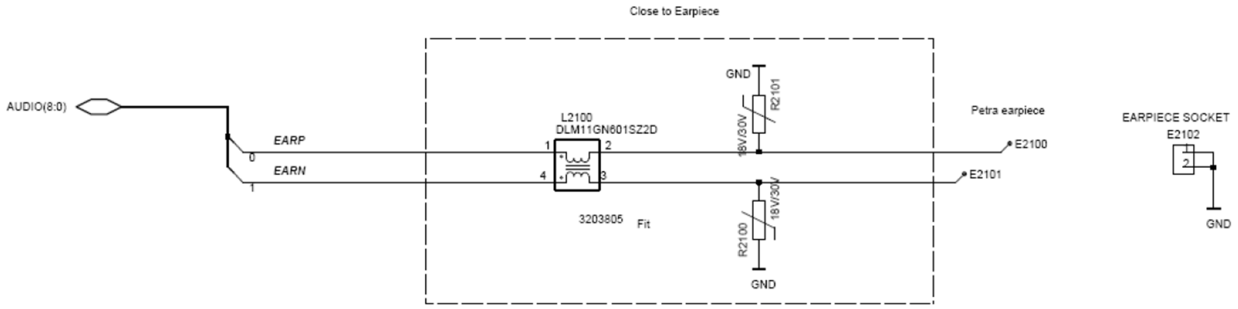

Close to Earpiece
AUDIO(8:0)
EARP
EARN
0
1
L2100
DLM11GN601SZ2D
1
2
4
3
3203805
Fit
GND
R2101
18V/30V
R2100
18V/30V
GND
Petra earpiece
E2100
E2101
EARPIECE SOCKET
E2102
1
2
GND

Figure 58 Internal earpiece circuitry

Internal speaker

Internal speaker is used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

One dynamic 11 x 15mm speaker is connected to Avilmas ASIC's D-class IHF amplifier outputs HFSpP HFSpN.

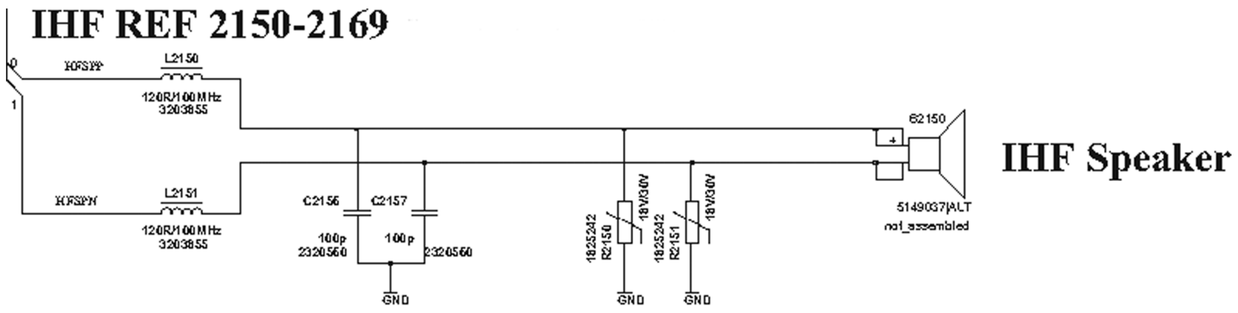

IHF REF 2150-2169
0
1
HFSPP
HFSPN
L2150
120R/100MHz
3203855
L2151
120R/100MHz
3203855
C2156
C2157
100p
2320560
100p
2320560
GND
1825242
R2150
18V/30V
1825242
R2151
18V/30V
GND
GND
B2150
+
5149037|ALT
not_assembled
IHF Speaker

Figure 59 Internal speaker

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

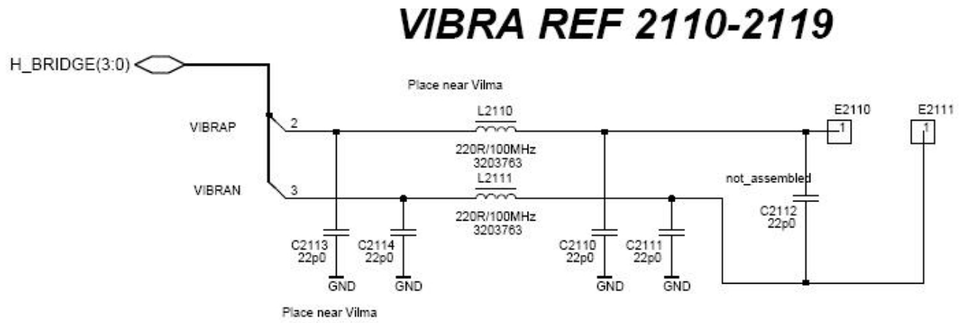

VIBRA REF 2110-2119
H_BRIDGE(3:0)
Place near Vilma
VIBRAP
2
VIBRAN
3
L2110
220R/100MHz
3203763
L2111
220R/100MHz
3203763
C2113
22p0
C2114
22p0
C2110
22p0
C2111
22p0
GND
GND
GND
GND
Place near Vilma
not_assembled
C2112
22p0
E2110
1
E2111
1

Figure 60 Vibra circuitry

External earpiece and microphone

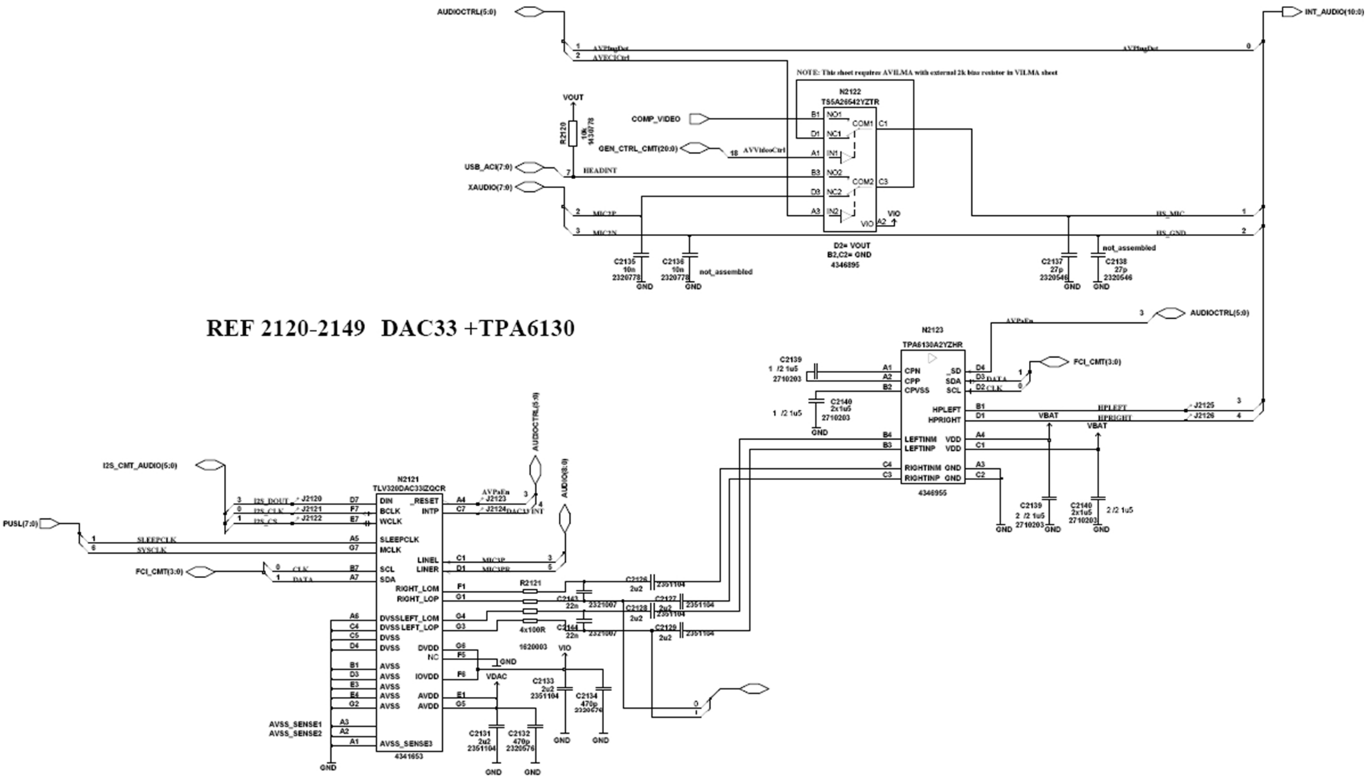

REF 2120-2149 DAC33 +TPA6130
AUDIOCTRL(5:0)
AVPlugDet
AVECICtrl
NOTE: This sheet requires AVILMA with external 2k bias resistor in VILMA sheet
N2122
TS5A26542YZTR
NO1
NC1
IN1
NO2
NC2
IN2
COM1
COM2
VIO
D2= VOUT
B2,C2= GND
4346895
VOUT
R2120
10k
1430778
COMP_VIDEO
GEN_CTRL_CMT(20:0)
AVVideoCtrl
USB_ACI(7:0)
HEADINT
XAUDIO(7:0)
MIC2P
MIC2N
C2135
10n
2320778
C2136
10n
2320778
not_assembled
GND
INT_AUDIO(10:0)
HS_MIC
HS_GND
C2137
27p
2320546
C2138
27p
2320546
AVPaEn
N2123
TPA6130A2YZHR
CPN
CPP
CPVSS
_SD
SDA
SCL
HPLEFT
HPRIGHT
LEFTINM
LEFTINP
RIGHTINM
RIGHTINP
VDD
GND
4346955
C2139
1 /2 1u5
2710203
C2140
2x1u5
2710203
FCI_CMT(3:0)
DATA
CLK
J2125
J2126
VBAT
2 /2 1u5
I2S_CMT_AUDIO(5:0)
PUSL(7:0)
I2S_DOUT
I2S_CLK
I2S_CS
J2120
J2121
J2122
SLEEPCLK
SYSCLK
N2121
TLV320DAC33IZQCR
DIN
BCLK
WCLK
MCLK
SDA
_RESET
INTP
LINEL
LINER
RIGHT_LOM
RIGHT_LOP
LEFT_LOM
LEFT_LOP
DVSS
AVSS
DVDD
NC
IOVDD
AVDD
AVSS_SENSE1
AVSS_SENSE2
AVSS_SENSE3
4341653
J2123
J2124
DAC33INT
AUDIO(8:0)
MIC3P
MIC3PR
R2121
4x100R
1620003
C2143
22n
2321007
C2144
C2126
C2127
C2128
C2129
2u2
2351104
VDAC
VIO
C2131
C2132
470p
2320676
C2133
C2134

Figure 61 External earpiece and microphone audio circuit

Baseband technical specifications

External interfaces

Name of connection	Connector reference
HS USB	X3300
MicroSD card	X3200
Battery connector	X2070
SIM card reader	X2700
Accessory (AV) connector	X2010
Charger	X3300

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card

Pin	Signal	I/O	Engine connection		Notes
3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
5	GND	-	GND		Ground
7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output

Charger connector and charging interface connections & electrical characteristics

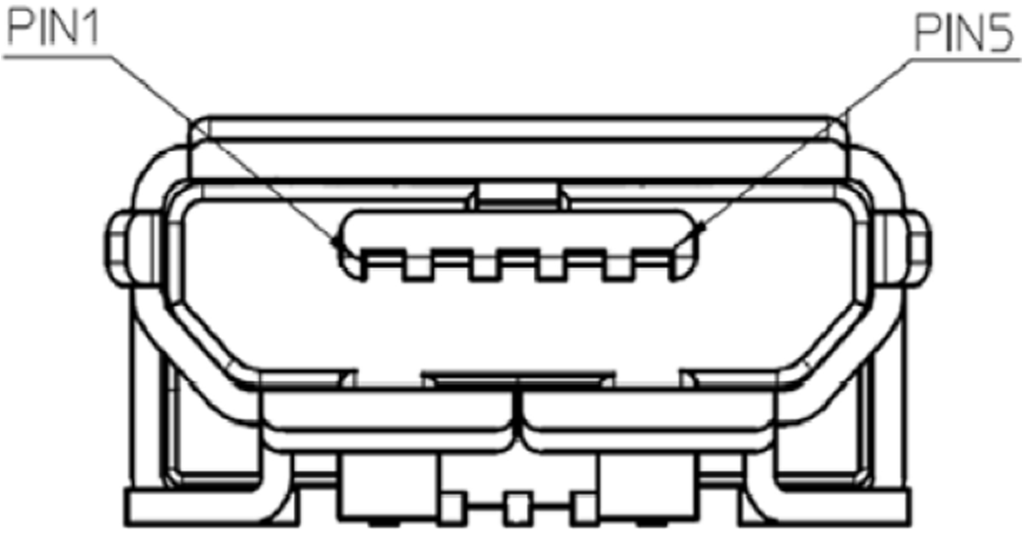


Figure 62 Charger connector

Table 7 Charging interface connections

PIN	Signal	I/O	Engine connection		Description
1	VBUS	IN	D3300/ N3301	VBUS/DCIN	5V
2	D-	IN/OUT	D3300	DM	Data minus
3	D+	IN/OUT	D3300	DN	Data plus
4	ID				Not in use
5	ground		Ground		Signal ground

Table 8 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit
VBUS	Vcharge	4.75	5.25	V
VBUS	Icharge		1.8	A
D+,D-,Ground			1	A

Internal interfaces

Name of connection	Component reference
DALS in UI flex	N6502
Earpiece	B2100
Microphone	B2170
IHF speaker on B-cover	
Main camera socket on flex	
Sub-camera on flex	
Main display connector on flex	
Vibra	M2110

Back-up battery interface electrical characteristics

Table 9 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.6	V

RF technical description

RF block diagram

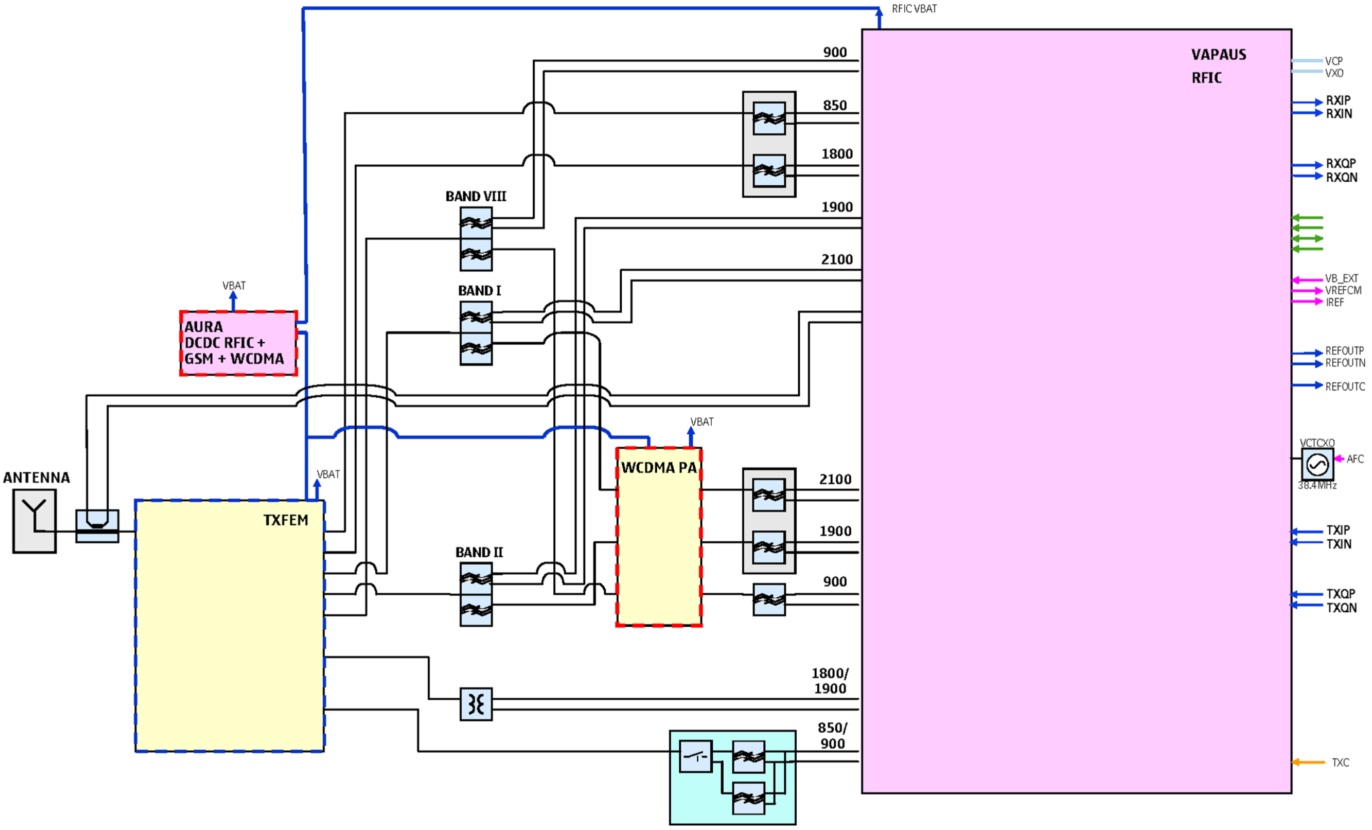

RFIC VBAT
VAPAUS
RFIC
900
850
1800
1900
2100
BAND VIII
BAND I
VBAT
AURA
DCDC RFIC +
GSM + WCDMA
VBAT
ANTENNA
VBAT
TXFEM
WCDMA PA
2100
1900
900
BAND II
1800/
1900
850/
900
VCP
VXO
RXIP
RXIN
RXQP
RXQN
VB_EXT
VREFCM
IREF
REFOUTP
REFOUTN
REFOUTC
VCTCXO
AFC
38.4MHz
TXIP
TXIN
TXQP
TXQN
TXC

Figure 63 RF block diagram RM-465 using RF ASIC N7500

The RF block diagram uses RF ASIC N7500 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

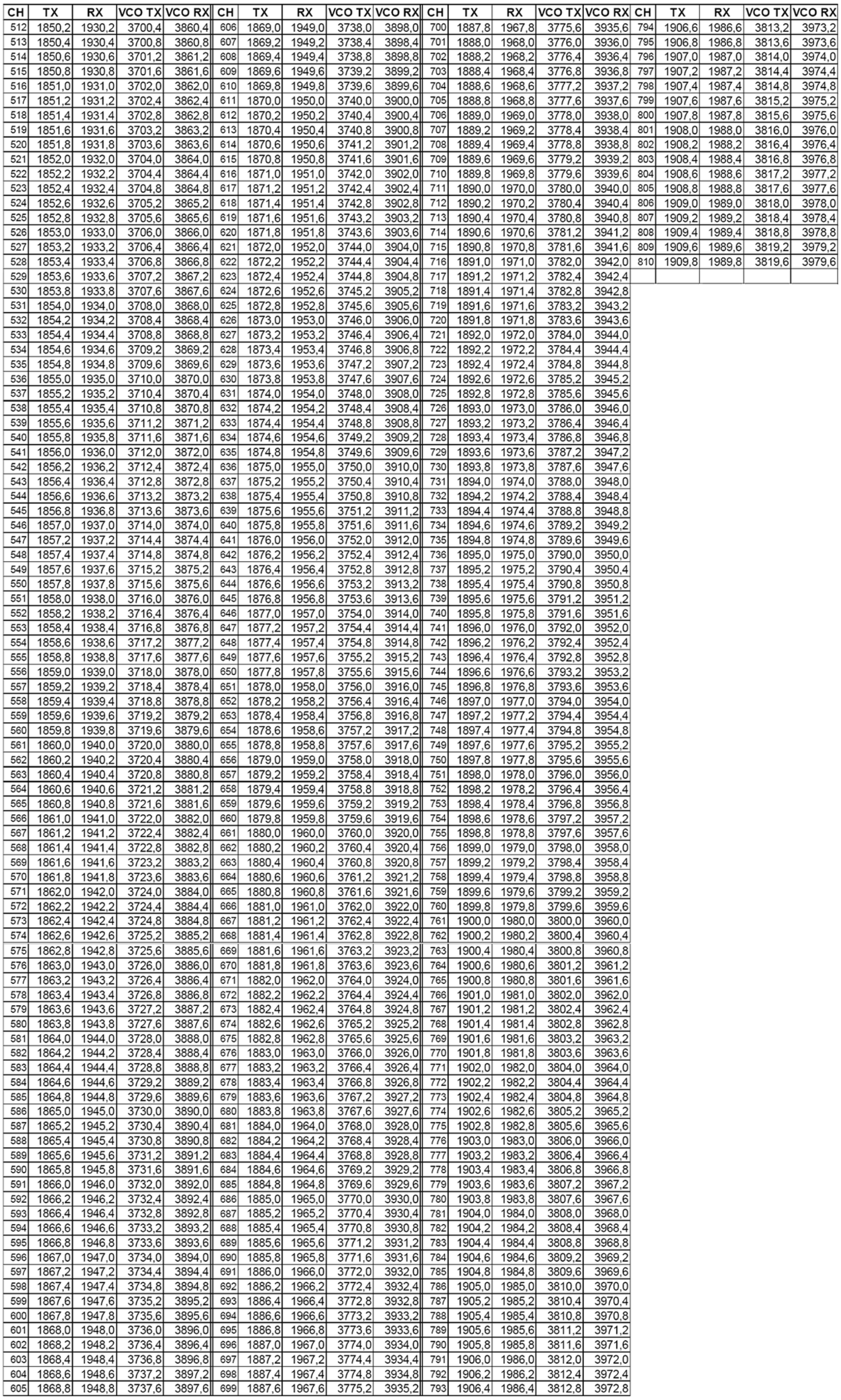
EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies



CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA I (2100) Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA I (2100) Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

WCDMA II (1900) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX
9262	9662	1852.4	1932.4	3704.8	3864.8
12	412	1852.5	1932.5	3705.0	3865.0
9263	9663	1852.6	1932.6	3705.2	3865.2
9264	9664	1852.8	1932.8	3705.6	3865.6
9265	9665	1853.0	1933.0	3706.0	3866.0
9266	9666	1853.2	1933.2	3706.4	3866.4
9267	9667	1853.4	1933.4	3706.8	3866.8
9268	9668	1853.6	1933.6	3707.2	3867.2
9269	9669	1853.8	1933.8	3707.6	3867.6
9270	9670	1854.0	1934.0	3708.0	3868.0
9271	9671	1854.2	1934.2	3708.4	3868.4
9272	9672	1854.4	1934.4	3708.8	3868.8
9273	9673	1854.6	1934.6	3709.2	3869.2
9274	9674	1854.8	1934.8	3709.6	3869.6
9275	9675	1855.0	1935.0	3710.0	3870.0
9276	9676	1855.2	1935.2	3710.4	3870.4
9277	9677	1855.4	1935.4	3710.8	3870.8
9278	9678	1855.6	1935.6	3711.2	3871.2
9279	9679	1855.8	1935.8	3711.6	3871.6
9280	9680	1856.0	1936.0	3712.0	3872.0
9281	9681	1856.2	1936.2	3712.4	3872.4
9282	9682	1856.4	1936.4	3712.8	3872.8
9283	9683	1856.6	1936.6	3713.2	3873.2
9284	9684	1856.8	1936.8	3713.6	3873.6
9285	9685	1857.0	1937.0	3714.0	3874.0
9286	9686	1857.2	1937.2	3714.4	3874.4
9287	9687	1857.4	1937.4	3714.8	3874.8
37	437	1857.5	1937.5	3715.0	3875.0
9288	9688	1857.6	1937.6	3715.2	3875.2
9289	9689	1857.8	1937.8	3715.6	3875.6
9290	9690	1858.0	1938.0	3716.0	3876.0
9291	9691	1858.2	1938.2	3716.4	3876.4
9292	9692	1858.4	1938.4	3716.8	3876.8
9293	9693	1858.6	1938.6	3717.2	3877.2
9294	9694	1858.8	1938.8	3717.6	3877.6
9295	9695	1859.0	1939.0	3718.0	3878.0
9296	9696	1859.2	1939.2	3718.4	3878.4
9297	9697	1859.4	1939.4	3718.8	3878.8
9298	9698	1859.6	1939.6	3719.2	3879.2
9299	9699	1859.8	1939.8	3719.6	3879.6
9300	9700	1860.0	1940.0	3720.0	3880.0
9301	9701	1860.2	1940.2	3720.4	3880.4
9302	9702	1860.4	1940.4	3720.8	3880.8
9303	9703	1860.6	1940.6	3721.2	3881.2
9304	9704	1860.8	1940.8	3721.6	3881.6
9305	9705	1861.0	1941.0	3722.0	3882.0
9306	9706	1861.2	1941.2	3722.4	3882.4
9307	9707	1861.4	1941.4	3722.8	3882.8
9308	9708	1861.6	1941.6	3723.2	3883.2
9309	9709	1861.8	1941.8	3723.6	3883.6
9310	9710	1862.0	1942.0	3724.0	3884.0
9311	9711	1862.2	1942.2	3724.4	3884.4
9312	9712	1862.4	1942.4	3724.8	3884.8
62	462	1862.5	1942.5	3725.0	3885.0
9313	9713	1862.6	1942.6	3725.2	3885.2
9314	9714	1862.8	1942.8	3725.6	3885.6
9315	9715	1863.0	1943.0	3726.0	3886.0
9316	9716	1863.2	1943.2	3726.4	3886.4
9317	9717	1863.4	1943.4	3726.8	3886.8
9318	9718	1863.6	1943.6	3727.2	3887.2
9319	9719	1863.8	1943.8	3727.6	3887.6
9320	9720	1864.0	1944.0	3728.0	3888.0
9321	9721	1864.2	1944.2	3728.4	3888.4
9322	9722	1864.4	1944.4	3728.8	3888.8
9323	9723	1864.6	1944.6	3729.2	3889.2
9324	9724	1864.8	1944.8	3729.6	3889.6
9325	9725	1865.0	1945.0	3730.0	3890.0
9326	9726	1865.2	1945.2	3730.4	3890.4
9327	9727	1865.4	1945.4	3730.8	3890.8
9328	9728	1865.6	1945.6	3731.2	3891.2
9329	9729	1865.8	1945.8	3731.6	3891.6
9330	9730	1866.0	1946.0	3732.0	3892.0
9331	9731	1866.2	1946.2	3732.4	3892.4
9332	9732	1866.4	1946.4	3732.8	3892.8
9333	9733	1866.6	1946.6	3733.2	3893.2
9334	9734	1866.8	1946.8	3733.6	3893.6
9335	9735	1867.0	1947.0	3734.0	3894.0
9336	9736	1867.2	1947.2	3734.4	3894.4
9337	9737	1867.4	1947.4	3734.8	3894.8
87	487	1867.5	1947.5	3735.0	3895.0
9338	9738	1867.6	1947.6	3735.2	3895.2
9339	9739	1867.8	1947.8	3735.6	3895.6
9340	9740	1868.0	1948.0	3736.0	3896.0
9341	9741	1868.2	1948.2	3736.4	3896.4
9342	9742	1868.4	1948.4	3736.8	3896.8
9343	9743	1868.6	1948.6	3737.2	3897.2
9344	9744	1868.8	1948.8	3737.6	3897.6
9345	9745	1869.0	1949.0	3738.0	3898.0
9346	9746	1869.2	1949.2	3738.4	3898.4
9347	9747	1869.4	1949.4	3738.8	3898.8
9348	9748	1869.6	1949.6	3739.2	3899.2
9349	9749	1869.8	1949.8	3739.6	3899.6
9350	9750	1870.0	1950.0	3740.0	3900.0
9351	9751	1870.2	1950.2	3740.4	3900.4
9352	9752	1870.4	1950.4	3740.8	3900.8
9353	9753	1870.6	1950.6	3741.2	3901.2
9354	9754	1870.8	1950.8	3741.6	3901.6
9355	9755	1871.0	1951.0	3742.0	3902.0
9356	9756	1871.2	1951.2	3742.4	3902.4
9357	9757	1871.4	1951.4	3742.8	3902.8
9358	9758	1871.6	1951.6	3743.2	3903.2
9359	9759	1871.8	1951.8	3743.6	3903.6
9360	9760	1872.0	1952.0	3744.0	3904.0
9361	9761	1872.2	1952.2	3744.4	3904.4
9362	9762	1872.4	1952.4	3744.8	3904.8
112	512	1872.5	1952.5	3745.0	3905.0
9363	9763	1872.6	1952.6	3745.2	3905.2
9364	9764	1872.8	1952.8	3745.6	3905.6
9365	9765	1873.0	1953.0	3746.0	3906.0
9366	9766	1873.2	1953.2	3746.4	3906.4
9367	9767	1873.4	1953.4	3746.8	3906.8
9368	9768	1873.6	1953.6	3747.2	3907.2
9369	9769	1873.8	1953.8	3747.6	3907.6
9370	9770	1874.0	1954.0	3748.0	3908.0
9371	9771	1874.2	1954.2	3748.4	3908.4
9372	9772	1874.4	1954.4	3748.8	3908.8
9373	9773	1874.6	1954.6	3749.2	3909.2
9374	9774	1874.8	1954.8	3749.6	3909.6
9375	9775	1875.0	1955.0	3750.0	3910.0
9376	9776	1875.2	1955.2	3750.4	3910.4
9377	9777	1875.4	1955.4	3750.8	3910.8
9378	9778	1875.6	1955.6	3751.2	3911.2
9379	9779	1875.8	1955.8	3751.6	3911.6
9380	9780	1876.0	1956.0	3752.0	3912.0
9381	9781	1876.2	1956.2	3752.4	3912.4
9382	9782	1876.4	1956.4	3752.8	3912.8
9383	9783	1876.6	1956.6	3753.2	3913.2
9384	9784	1876.8	1956.8	3753.6	3913.6
9385	9785	1877.0	1957.0	3754.0	3914.0
9386	9786	1877.2	1957.2	3754.4	3914.4
9387	9787	1877.4	1957.4	3754.8	3914.8
137	537	1877.5	1957.5	3755.0	3915.0
9388	9788	1877.6	1957.6	3755.2	3915.2
9389	9789	1877.8	1957.8	3755.6	3915.6
9390	9790	1878.0	1958.0	3756.0	3916.0
9391	9791	1878.2	1958.2	3756.4	3916.4
9392	9792	1878.4	1958.4	3756.8	3916.8
9393	9793	1878.6	1958.6	3757.2	3917.2
9394	9794	1878.8	1958.8	3757.6	3917.6
9395	9795	1879.0	1959.0	3758.0	3918.0
9396	9796	1879.2	1959.2	3758.4	3918.4
9397	9797	1879.4	1959.4	3758.8	3918.8
9398	9798	1879.6	1959.6	3759.2	3919.2
9399	9799	1879.8	1959.8	3759.6	3919.6
9400	9800	1880.0	1960.0	3760.0	3920.0
9401	9801	1880.2	1960.2	3760.4	3920.4
9402	9802	1880.4	1960.4	3760.8	3920.8
9403	9803	1880.6	1960.6	3761.2	3921.2
9404	9804	1880.8	1960.8	3761.6	3921.6
9405	9805	1881.0	1961.0	3762.0	3922.0
9406	9806	1881.2	1961.2	3762.4	3922.4
9407	9807	1881.4	1961.4	3762.8	3922.8
9408	9808	1881.6	1961.6	3763.2	3923.2
9409	9809	1881.8	1961.8	3763.6	3923.6
9410	9810	1882.0	1962.0	3764.0	3924.0
9411	9811	1882.2	1962.2	3764.4	3924.4
9412	9812	1882.4	1962.4	3764.8	3924.8
162	562	1882.5	1962.5	3765.0	3925.0
9413	9813	1882.6	1962.6	3765.2	3925.2
9414	9814	1882.8	1962.8	3765.6	3925.6
9415	9815	1883.0	1963.0	3766.0	3926.0
9416	9816	1883.2	1963.2	3766.4	3926.4
9417	9817	1883.4	1963.4	3766.8	3926.8
9418	9818	1883.6	1963.6	3767.2	3927.2
9419	9819	1883.8	1963.8	3767.6	3927.6
9420	9820	1884.0	1964.0	3768.0	3928.0
9421	9821	1884.2	1964.2	3768.4	3928.4
9422	9822	1884.4	1964.4	3768.8	3928.8
9423	9823	1884.6	1964.6	3769.2	3929.2
9424	9824	1884.8	1964.8	3769.6	3929.6
9425	9825	1885.0	1965.0	3770.0	3930.0
9426	9826	1885.2	1965.2	3770.4	3930.4
9427	9827	1885.4	1965.4	3770.8	3930.8
9428	9828	1885.6	1965.6	3771.2	3931.2
9429	9829	1885.8	1965.8	3771.6	3931.6
9430	9830	1886.0	1966.0	3772.0	3932.0
9431	9831	1886.2	1966.2	3772.4	3932.4
9432	9832	1886.4	1966.4	3772.8	3932.8
9433	9833	1886.6	1966.6	3773.2	3933.2
9434	9834	1886.8	1966.8	3773.6	3933.6
9435	9835	1887.0	1967.0	3774.0	3934.0
9436	9836	1887.2	1967.2	3774.4	3934.4
9437	9837	1887.4	1967.4	3774.8	3934.8
187	587	1887.5	1967.5	3775.0	3935.0
9438	9838	1887.6	1967.6	3775.2	3935.2
9439	9839	1887.8	1967.8	3775.6	3935.6
9440	9840	1888.0	1968.0	3776.0	3936.0
9441	9841	1888.2	1968.2	3776.4	3936.4
9442	9842	1888.4	1968.4	3776.8	3936.8
9443	9843	1888.6	1968.6	3777.2	3937.2
9444	9844	1888.8	1968.8	3777.6	3937.6
9445	9845	1889.0	1969.0	3778.0	3938.0
9446	9846	1889.2	1969.2	3778.4	3938.4
9447	9847	1889.4	1969.4	3778.8	3938.8
9448	9848	1889.6	1969.6	3779.2	3939.2
9449	9849	1889.8	1969.8	3779.6	3939.6
9450	9850	1890.0	1970.0	3780.0	3940.0
9451	9851	1890.2	1970.2	3780.4	3940.4
9452	9852	1890.4	1970.4	3780.8	3940.8
9453	9853	1890.6	1970.6	3781.2	3941.2
9454	9854	1890.8	1970.8	3781.6	3941.6
9455	9855	1891.0	1971.0	3782.0	3942.0
9456	9856	1891.2	1971.2	3782.4	3942.4
9457	9857	1891.4	1971.4	3782.8	3942.8
9458	9858	1891.6	1971.6	3783.2	3943.2
9459	9859	1891.8	1971.8	3783.6	3943.6
9460	9860	1892.0	1972.0	3784.0	3944.0
9461	9861	1892.2	1972.2	3784.4	3944.4
9462	9862	1892.4	1972.4	3784.8	3944.8
212	612	1892.5	1972.5	3785.0	3945.0
9463	9863	1892.6	1972.6	3785.2	3945.2
9464	9864	1892.8	1972.8	3785.6	3945.6
9465	9865	1893.0	1973.0	3786.0	3946.0
9466	9866	1893.2	1973.2	3786.4	3946.4
9467	9867	1893.4	1973.4	3786.8	3946.8
9468	9868	1893.6	1973.6	3787.2	3947.2
9469	9869	1893.8	1973.8	3787.6	3947.6
9470	9870	1894.0	1974.0	3788.0	3948.0
9471	9871	1894.2	1974.2	3788.4	3948.4
9472	9872	1894.4	1974.4	3788.8	3948.8
9473	9873	1894.6	1974.6	3789.2	3949.2
9474	9874	1894.8	1974.8	3789.6	3949.6
9475	9875	1895.0	1975.0	3790.0	3950.0
9476	9876	1895.2	1975.2	3790.4	3950.4
9477	9877	1895.4	1975.4	3790.8	3950.8
9478	9878	1895.6	1975.6	3791.2	3951.2
9479	9879	1895.8	1975.8	3791.6	3951.6
9480	9880	1896.0	1976.0	3792.0	3952.0
9481	9881	1896.2	1976.2	3792.4	3952.4
9482	9882	1896.4	1976.4	3792.8	3952.8
9483	9883	1896.6	1976.6	3793.2	3953.2
9484	9884	1896.8	1976.8	3793.6	3953.6
9485	9885	1897.0	1977.0	3794.0	3954.0
9486	9886	1897.2	1977.2	3794.4	3954.4
9487	9887	1897.4	1977.4	3794.8	3954.8
237	637	1897.5	1977.5	3795.0	3955.0
9488	9888	1897.6	1977.6	3795.2	3955.2
9489	9889	1897.8	1977.8	3795.6	3955.6
9490	9890	1898.0	1978.0	3796.0	3956.0
9491	9891	1898.2	1978.2	3796.4	3956.4
9492	9892	1898.4	1978.4	3796.8	3956.8
9493	9893	1898.6	1978.6	3797.2	3957.2
9494	9894	1898.8	1978.8	3797.6	3957.6
9495	9895	1899.0	1979.0	3798.0	3958.0
9496	9896	1899.2	1979.2	3798.4	3958.4
9497	9897	1899.4	1979.4	3798.8	3958.8
9498	9898	1899.6	1979.6	3799.2	3959.2
9499	9899	1899.8	1979.8	3799.6	3959.6
9500	9900	1900.0	1980.0	3800.0	3960.0
9501	9901	1900.2	1980.2	3800.4	3960.4
9502	9902	1900.4	1980.4	3800.8	3960.8
9503	9903	1900.6	1980.6	3801.2	3961.2
9504	9904	1900.8	1980.8	3801.6	3961.6
9505	9905	1901.0	1981.0	3802.0	3962.0
9506	9906	1901.2	1981.2	3802.4	3962.4
9507	9907	1901.4	1981.4	3802.8	3962.8
9508	9908	1901.6	1981.6	3803.2	3963.2
9509	9909	1901.8	1981.8	3803.6	3963.6
9510	9910	1902.0	1982.0	3804.0	3964.0
9511	9911	1902.2	1982.2	3804.4	3964.4
9512	9912	1902.4	1982.4	3804.8	3964.8
262	662	1902.5	1982.5	3805.0	3965.0
9513	9913	1902.6	1982.6	3805.2	3965.2
9514	9914	1902.8	1982.8	3805.6	3965.6
9515	9915	1903.0	1983.0	3806.0	3966.0
9516	9916	1903.2	1983.2	3806.4	3966.4
9517	9917	1903.4	1983.4	3806.8	3966.8
9518	9918	1903.6	1983.6	3807.2	3967.2
9519	9919	1903.8	1983.8	3807.6	3967.6
9520	9920	1904.0	1984.0	3808.0	3968.0
9521	9921	1904.2	1984.2	3808.4	3968.4
9522	9922	1904.4	1984.4	3808.8	3968.8
9523	9923	1904.6	1984.6	3809.2	3969.2
9524	9924	1904.8	1984.8	3809.6	3969.6
9525	9925	1905.0	1985.0	3810.0	3970.0
9526	9926	1905.2	1985.2	3810.4	3970.4
9527	9927	1905.4	1985.4	3810.8	3970.8
9528	9928	1905.6	1985.6	3811.2	3971.2
9529	9929	1905.8	1985.8	3811.6	3971.6
9530	9930	1906.0	1986.0	3812.0	3972.0
9531	9931	1906.2	1986.2	3812.4	3972.4
9532	9932	1906.4	1986.4	3812.8	3972.8
9533	9933	1906.6	1986.6	3813.2	3973.2
9534	9934	1906.8	1986.8	3813.6	3973.6
9535	9935	1907.0	1987.0	3814.0	3974.0
9536	9936	1907.2	1987.2	3814.4	3974.4
9537	9937	1907.4	1987.4	3814.8	3974.8
287	687	1907.5	1987.5	3815.0	3975.0
9538	9938	1907.6	1987.6	3815.2	3975.2

WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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